
ELECTROCARDIOGRAPHIC TEST BOOK

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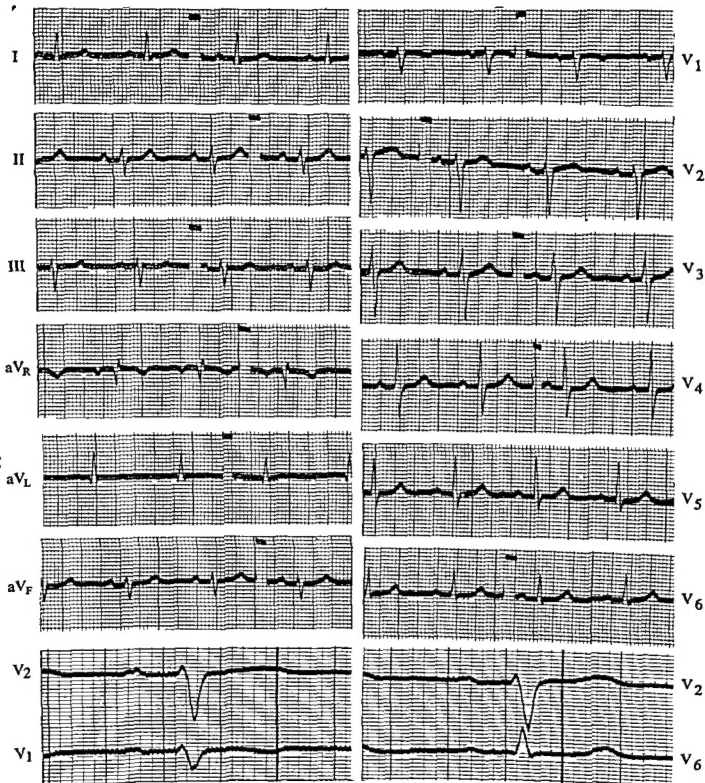
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PART A

ELECTROCARDIOGRAMS

70 YEAR OLD FEMALE NO CHEST PRESSURE OR PAIN CARDIAC CHECK UP NO DRUGS



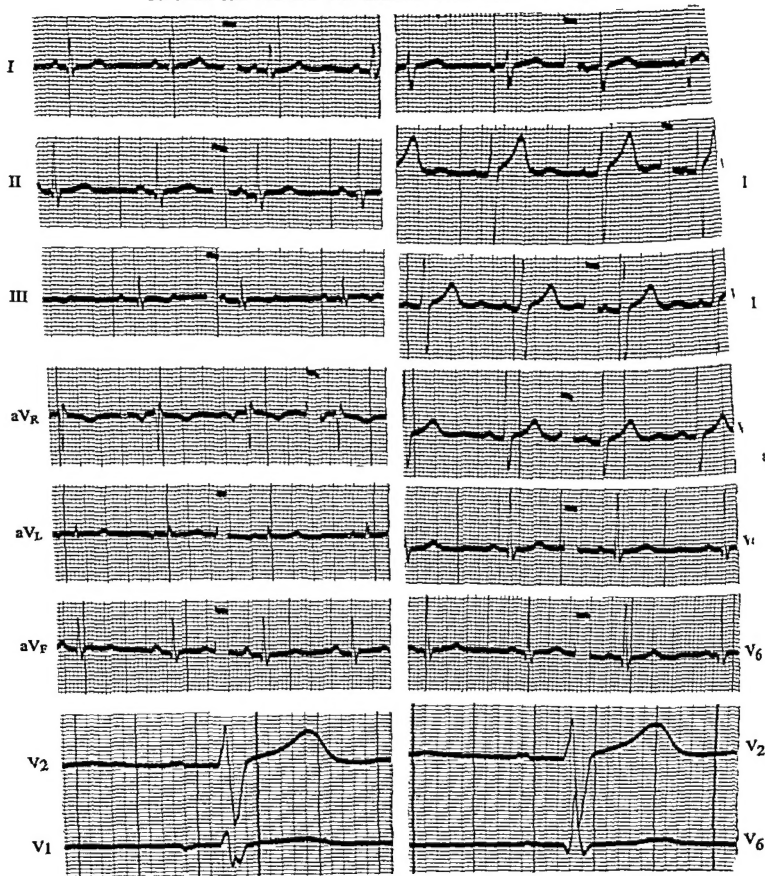
I The electrocardiographic position of the heart is

- A vertical
- B semi vertical
- C intermediate
- D semihorizontal
- E horizontal
- F indeterminate

II The electric axis of the QRS complexes is deviated somewhat to the

- A left
- B right

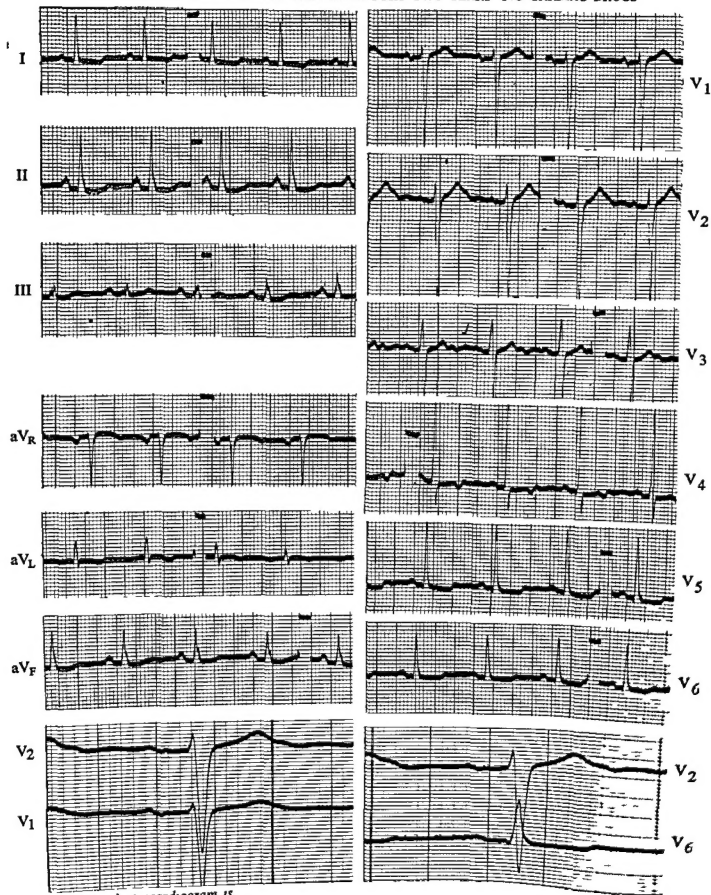
58 YEAR OLD FEMALE NO CARDIAC COMPLAINTS NO DRUGS



The rhythm is

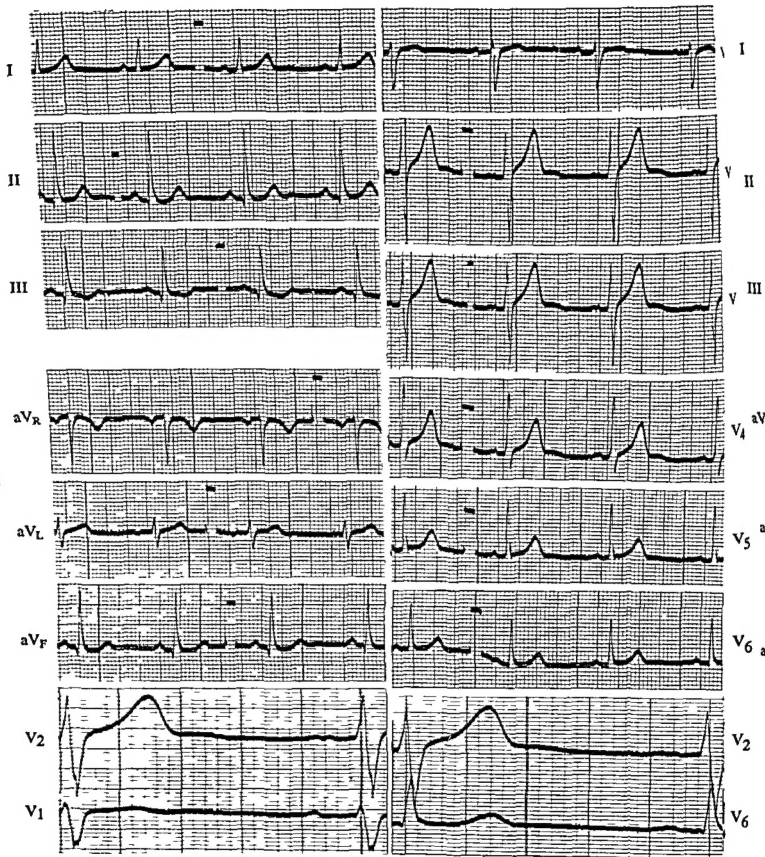
- A sinus bradycardia
- B nodal rhythm with retrograde conduction
- C normal sinus rhythm
- D sinus arrhythmia

58 year old male CHEST PAIN ON EFFORT TWO YEARS NO CARDIAC DRUGS



The electrocardiogram is

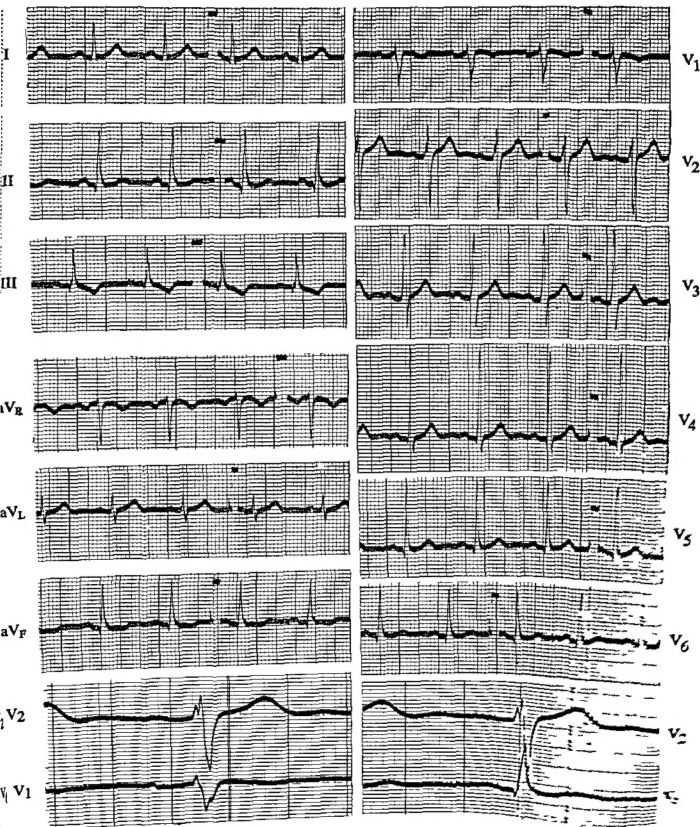
- A normal
- B diagnostic of a myocardial infarct
- C consistent with myocardial injury and/or ischemia
- D diagnostic of hypokalemia



The electrocardiogram is

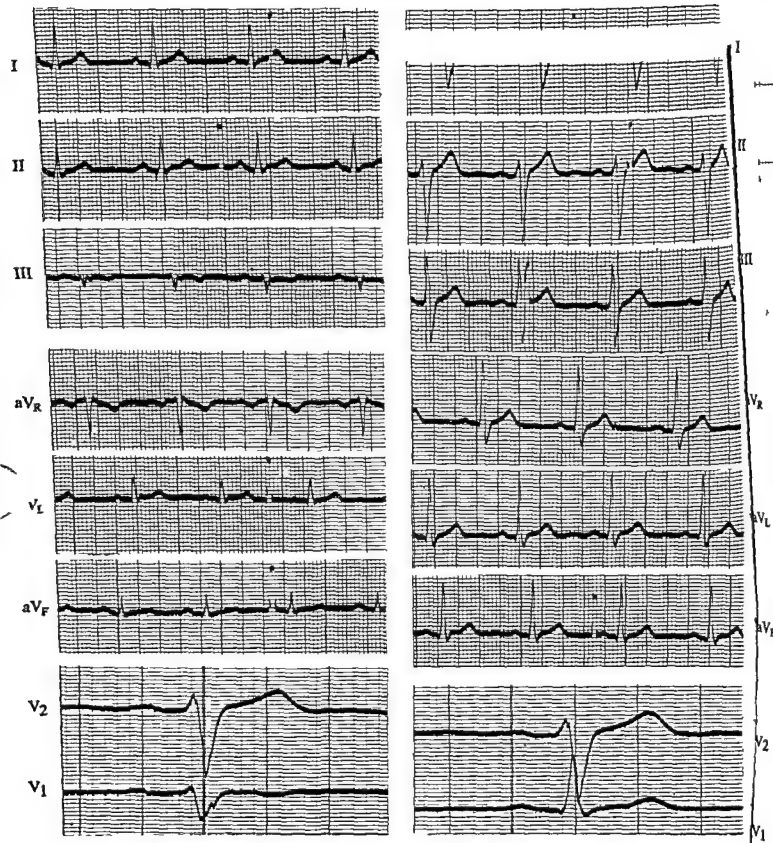
- A entirely normal
- B abnormal because of tall T waves in leads V_2 and V_3
- C abnormal because of the notched P waves in lead V_2
- D abnormal because of sagging of the ST segments in lead aV_F

47 year old male CHEST PAIN NO CARDIAC DRUGS



The tracing is

- A entirely normal
- B in keeping with posterior myocardial injury or ischemia
- C indicative of anterior myocardial infarction
- D diagnosis of left ventricular hypertrophy

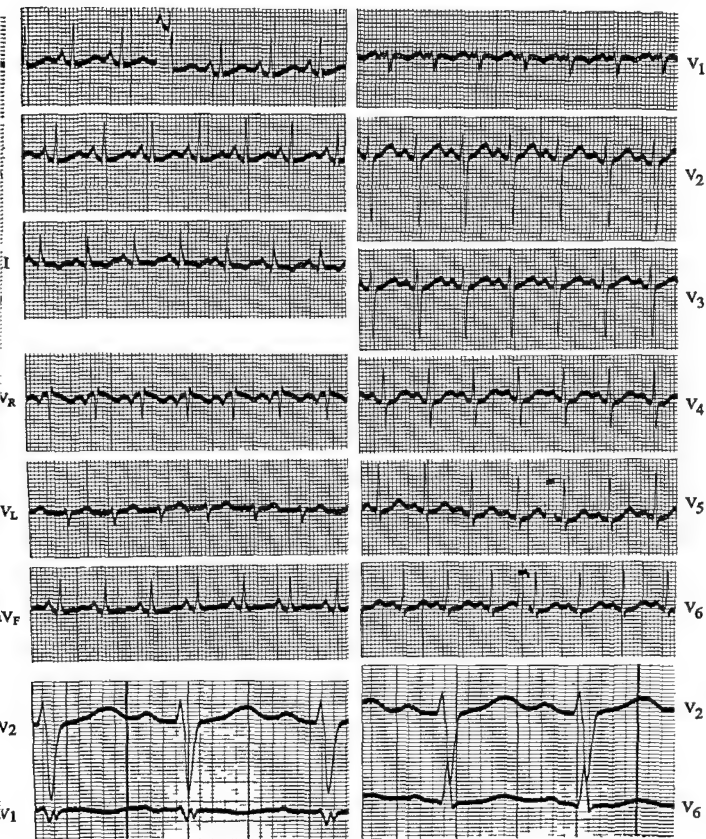


I The electrocardiographic position of the heart is

- A horizontal
- B semi horizontal
- C intermediate
- D vertical
- E semi vertical
- F indeterminate

II The QRS complexes are

- A of normal width
- B abnormally narrow
- C abnormally wide

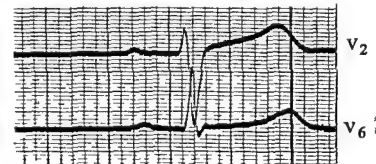
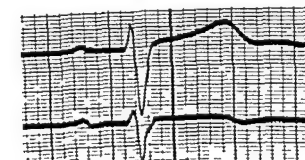
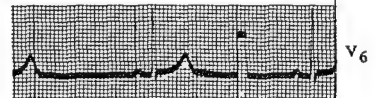
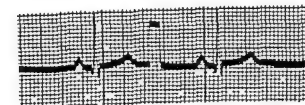
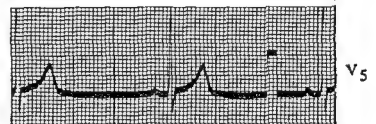
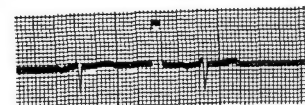
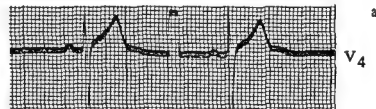
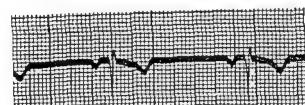
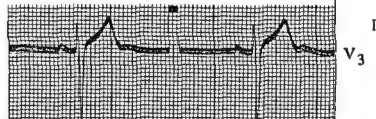
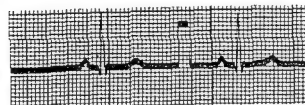
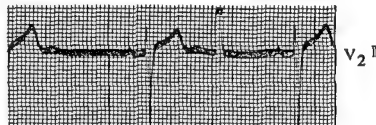
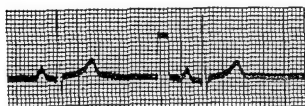
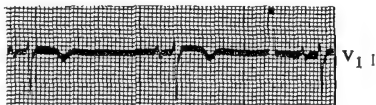
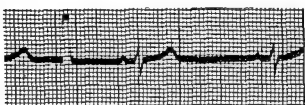


I The following is present

- A sinus arrhythmia
- B sinus tachycardia
- C nodal tachycardia
- D atrial tachycardia

II The negative ST segment shifts in lead V₄ are

- A diagnostic of disease
- B probably secondary to the rapid rate
- C indicative of pericarditis



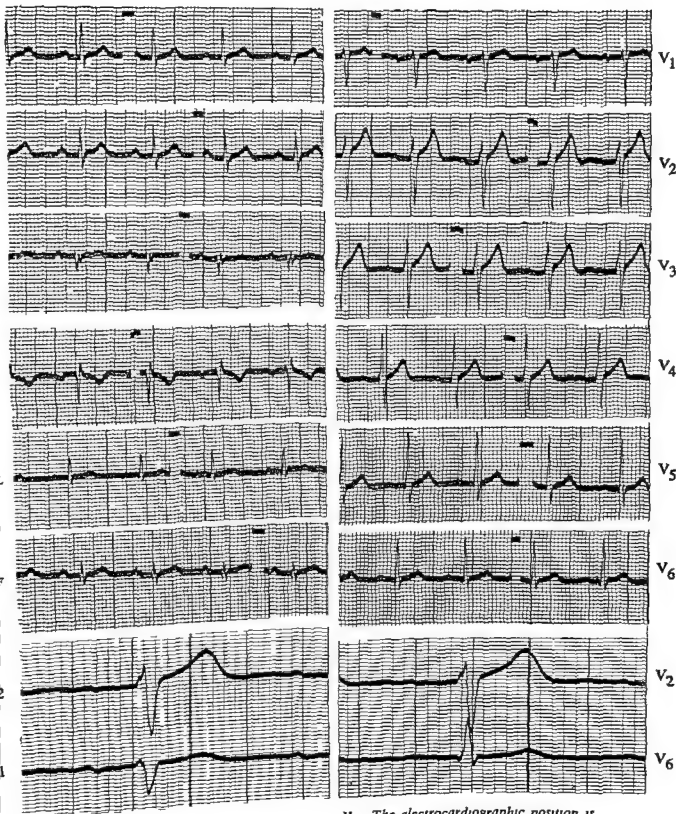
The following is present

- A normal sinus rhythm
- B sinus bradycardia,
- C sino-atrial block
- D sinus arrest

II The electrocardiographic position of the heart is

- A horizontal
- B intermediate
- C vertical

54 year old male CHEST PAIN ONE YEAR NO CARDIAC DRUGS



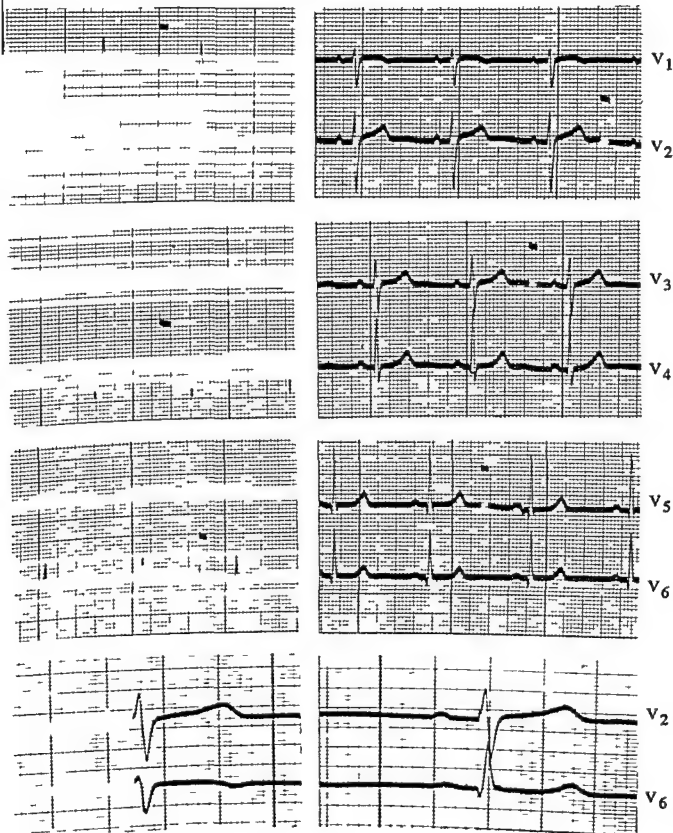
I The tracing is

- A normal
- B suggestive of cardiac disease
- C abnormal

II The electrocardiographic position is

- A horizontal
- B semi horizontal
- C intermediate
- D vertical
- E semi vertical
- F indeterminate

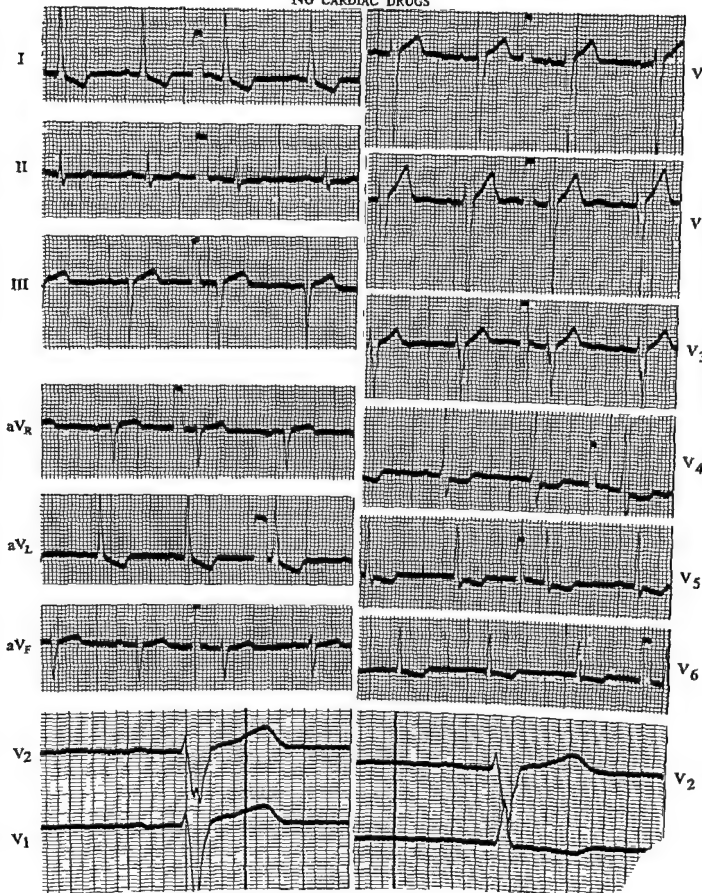
55 YEAR OLD FEMALE COMPLAINS OF YELLOW TUMORS ON EYELIDS



The Q waves in lead aVF are strongly suggestive of

- A an old posterior myocardial infarct
- B strong counterclockwise rotation of the heart about the long axis as viewed from the apex
- C normal ventricular depolarization
- D pulmonary infarction

55 YEAR OLD MALE CHECK UP SIX MONTHS AFTER ATTACK OF PULMONARY EDEMA
NO CARDIAC DRUGS



The electrocardiogram is typical of

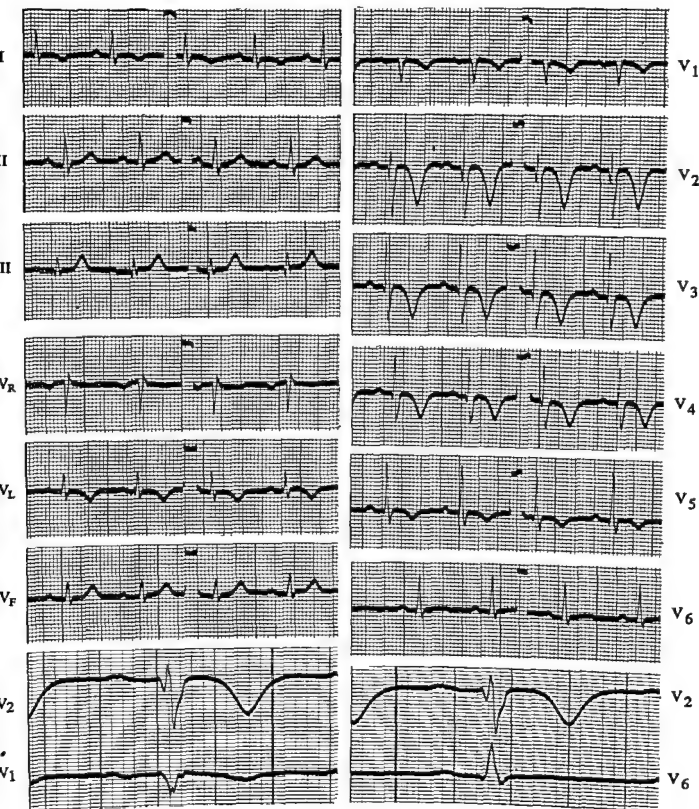
- A right and left ventricular hypertrophy
- B left ventricular hypertrophy /
- C complete left bundle branch block



The electrocardiogram

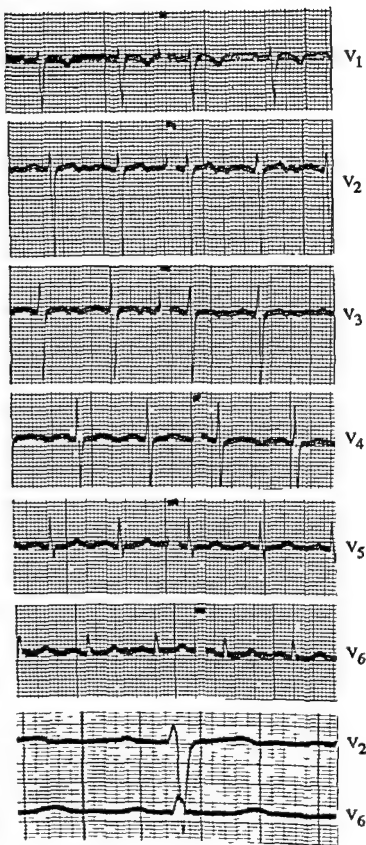
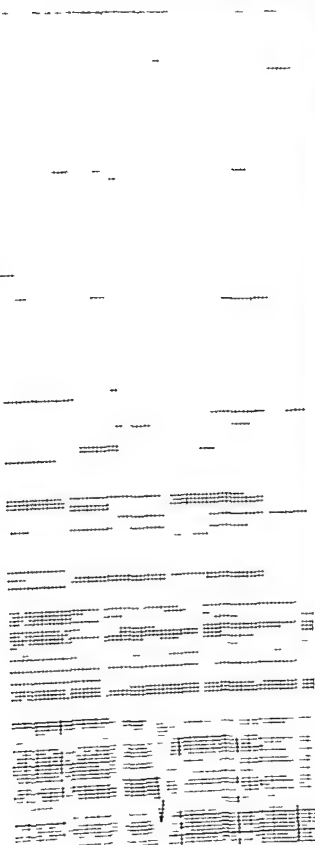
- A is entirely normal
- B is strongly suggestive of chronic pericarditis
- C is suggestive of subendocardial injury or ischemia
- D indicates abnormally late depolarization of the left ventricle

57 year old male CRUSHING PRECORDIAL PAIN FOR SIX HOURS TWELVE DAYS AGO



The electrocardiogram

- A indicates ischemia involving the subepicardial and anterolateral aspect of the left ventricle along with a small anteroapical infarct
- B indicates anterior myocardial ischemia and rules out an anterior infarct
- C is typical of an acute subendocardial infarct



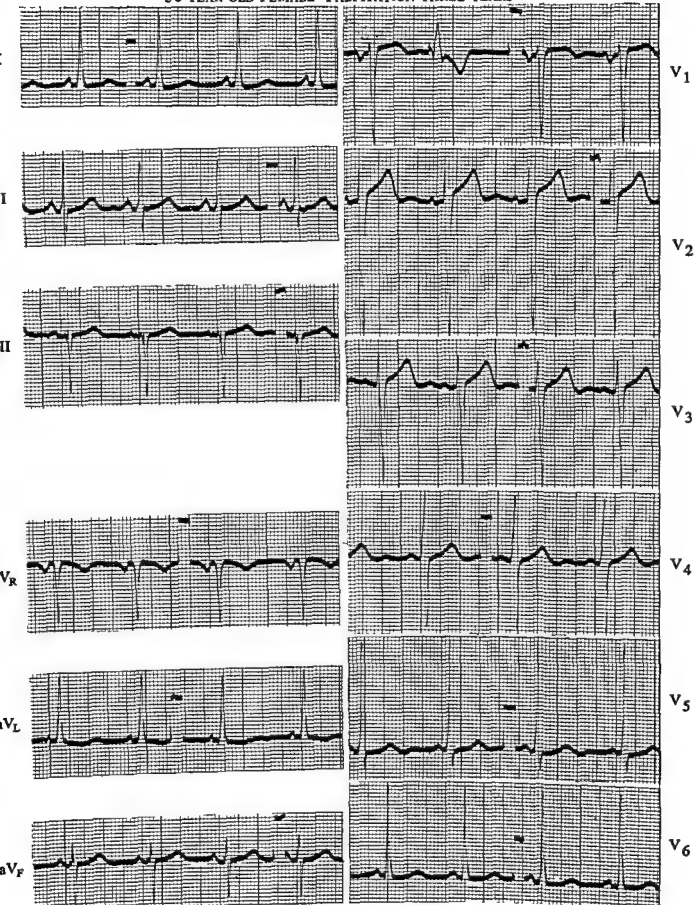
I The voltages of the QRS complexes in the standard leads

- A tend to be low
- B are near or are above average
- C are tall

II The QRS complexes are

- A of normal width
- B abnormally wide
- C abnormally narrow

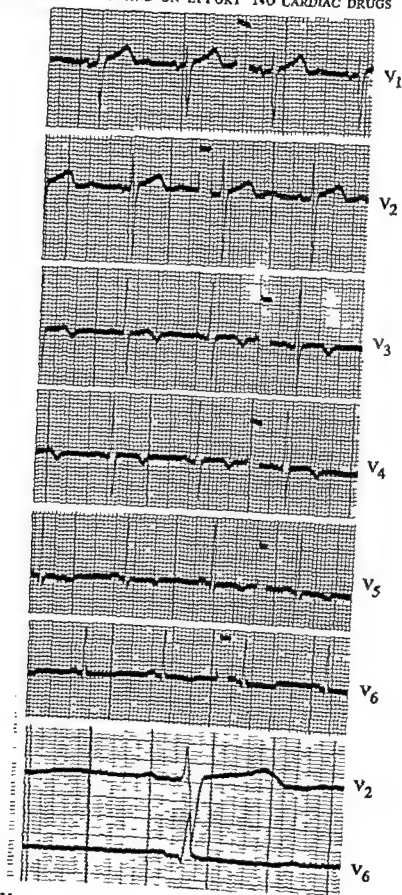
50 YEAR OLD FEMALE PALPITATION THREE YEARS



- I The following is present
- A left ventricular hypertrophy
 - B right and left ventricular hypertrophy
 - C an incomplete left bundle branch block
 - D a false bundle branch block

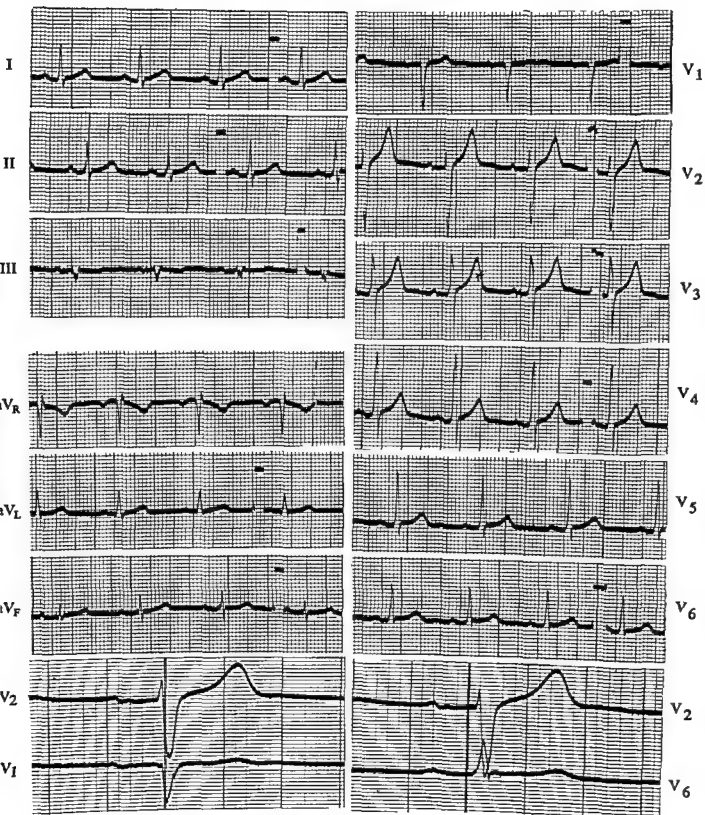
- II The following is present
- A a ventricular ectopic beat
 - B a nodal ectopic beat
 - C premature contraction

AN OLD MALE EPIGASTRIC DISTRESS ON LYING DOWN AND ON EFFORT NO CARDIAC DRUGS



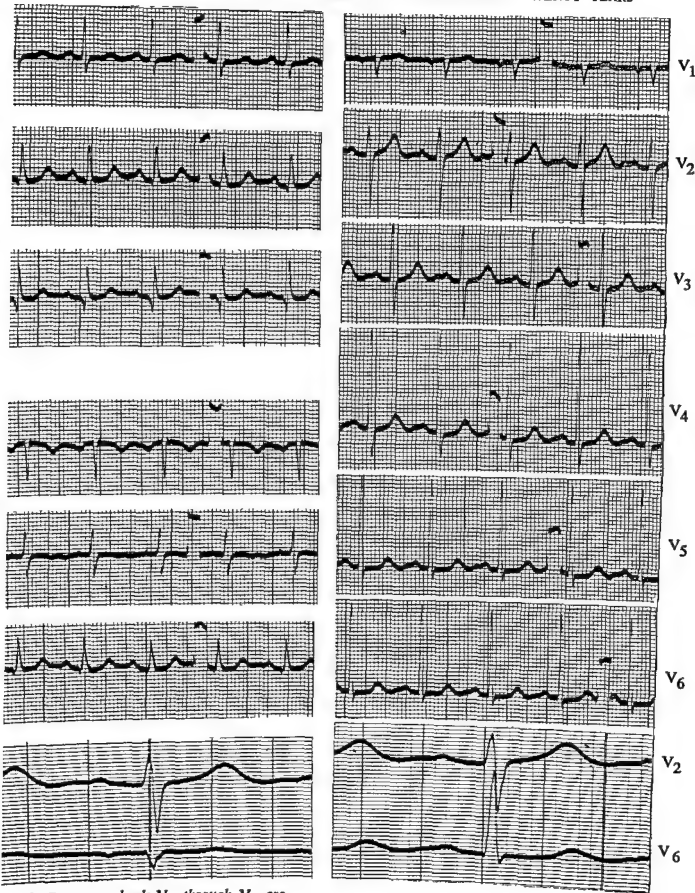
The inverted T waves in leads V3 V4 and V5 are

- A definite evidence of coronary artery disease
- B consistent with ischemia of the anterolateral aspect of the left ventricle
- C diagnostic of a myocardial infarct



The electrocardiogram is

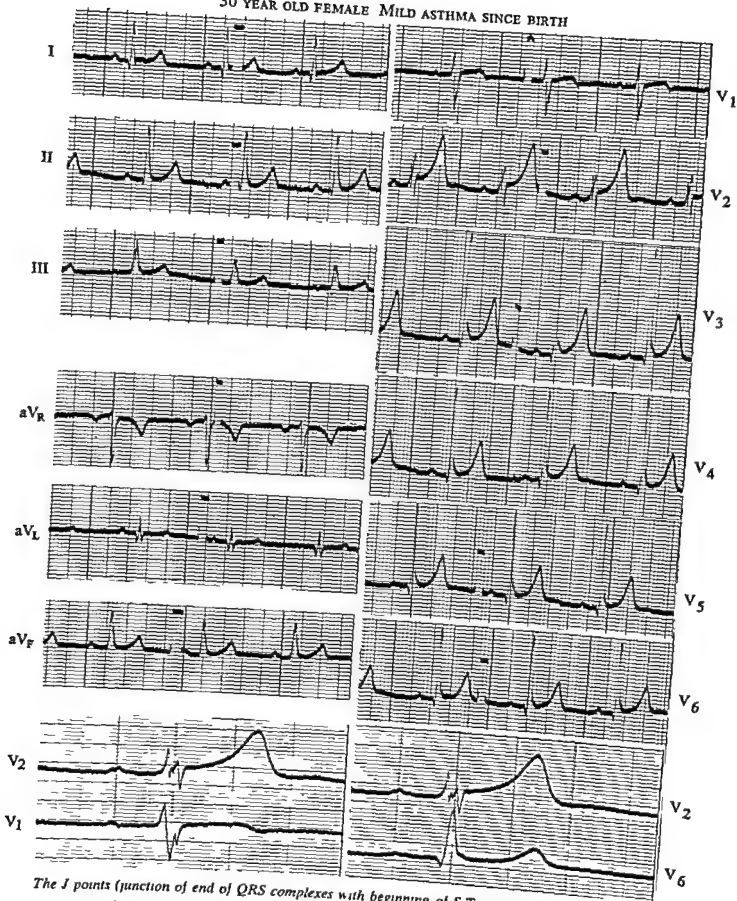
- A normal and rules out cardiac disease
- B normal however cardiac disease may be present
- C abnormal



The P waves in leads V₂ through V₆ are

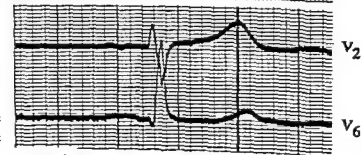
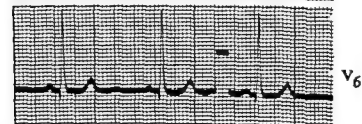
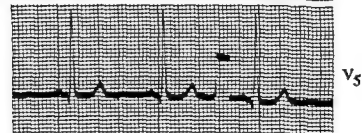
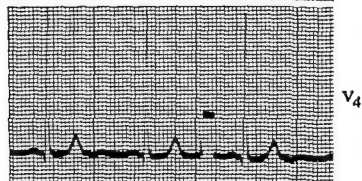
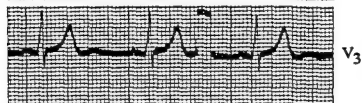
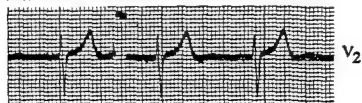
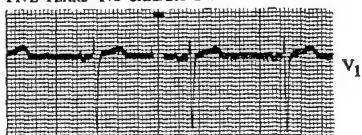
- A abnormally wide
- B appear wide because of the presence of U waves
- C suggest the presence of mitral stenosis
- D suggest right atrial enlargement

30 YEAR OLD FEMALE MILD ASTHMA SINCE BIRTH



The J points (junction of end of QRS complexes with beginning of ST segments) in lead V₂ are

- A indicative of cardiac disease
- B indicative of pericarditis
- C indicative of an electrolyte disturbance
- D probably normal

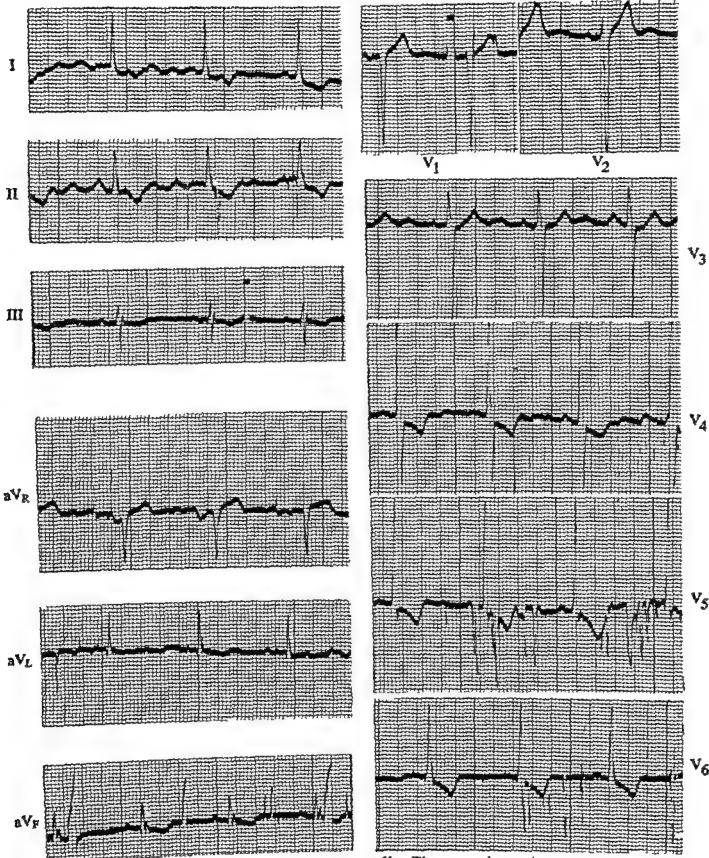


I The voltage of the R waves in lead V₄ is

- A low
- B normal
- C high

II The tracing suggests

- A right ventricular hypertrophy
- B left ventricular hypertrophy
- C no ventricular hypertrophy

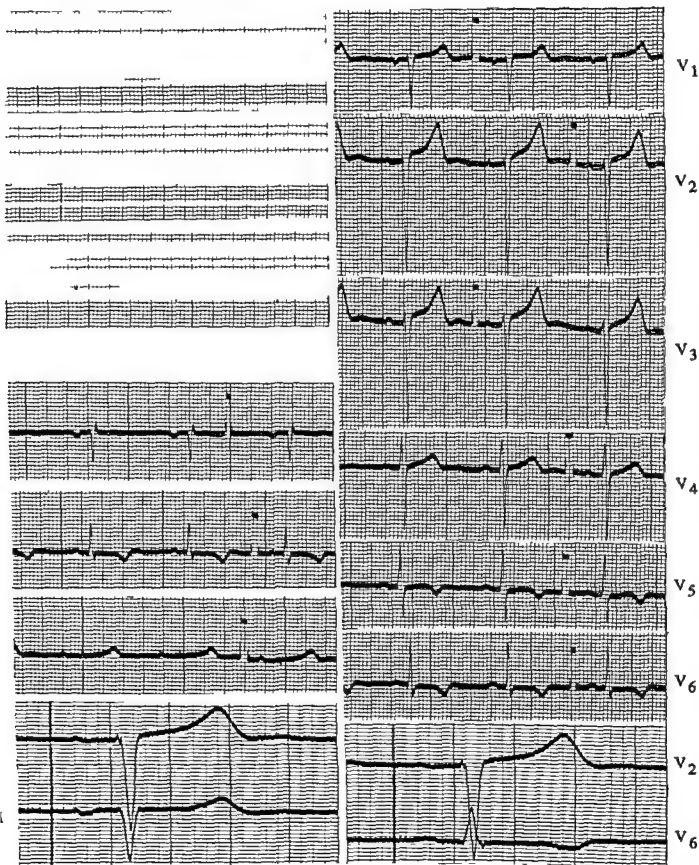


I The tracing shows the following

- A a lead is mounted upside down
- B there was movement of the electrode on the skin
- C there was a loose electric connection

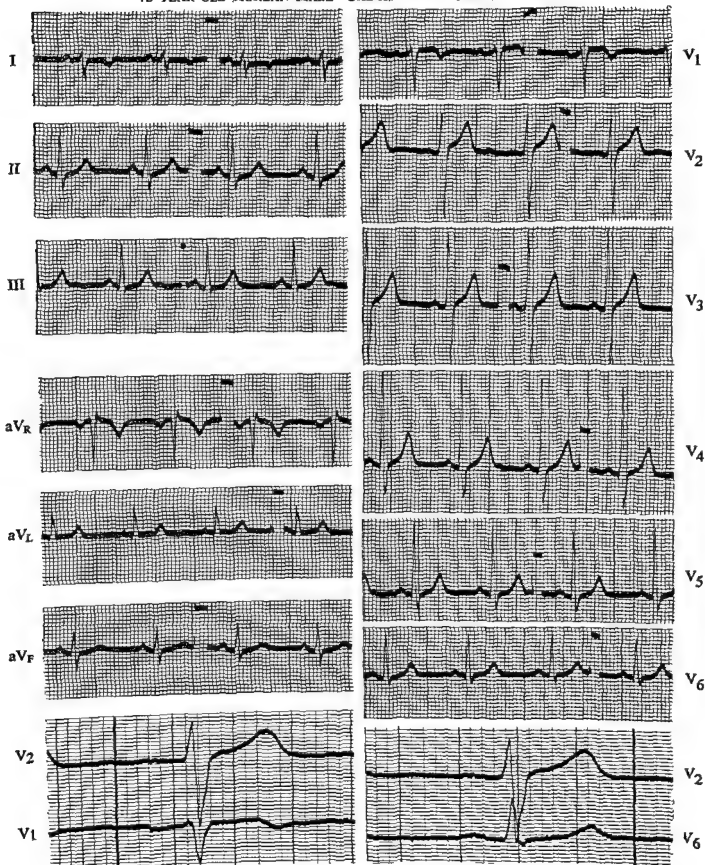
II There is evidence of

- A right and left ventricular hypertrophy
- B right ventricular hypertrophy
- C left ventricular hypertrophy



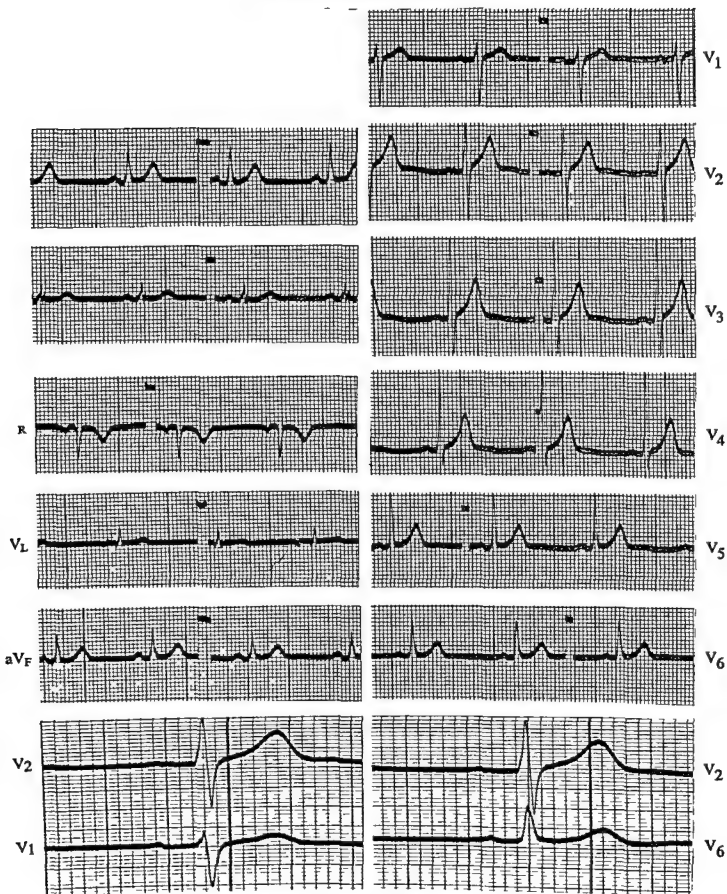
The electrocardiogram is

- A normal
- B in keeping with left ventricular hypertrophy with or without myocardial injury and ischemia
- C strongly suggestive of pulmonary infarction



The following artifact is present in the standard leads

- A leads I and III were interchanged when mounted
- B the right and left arm lead wires were switched when applied to the patient's limbs
- C lead I is mounted upside down

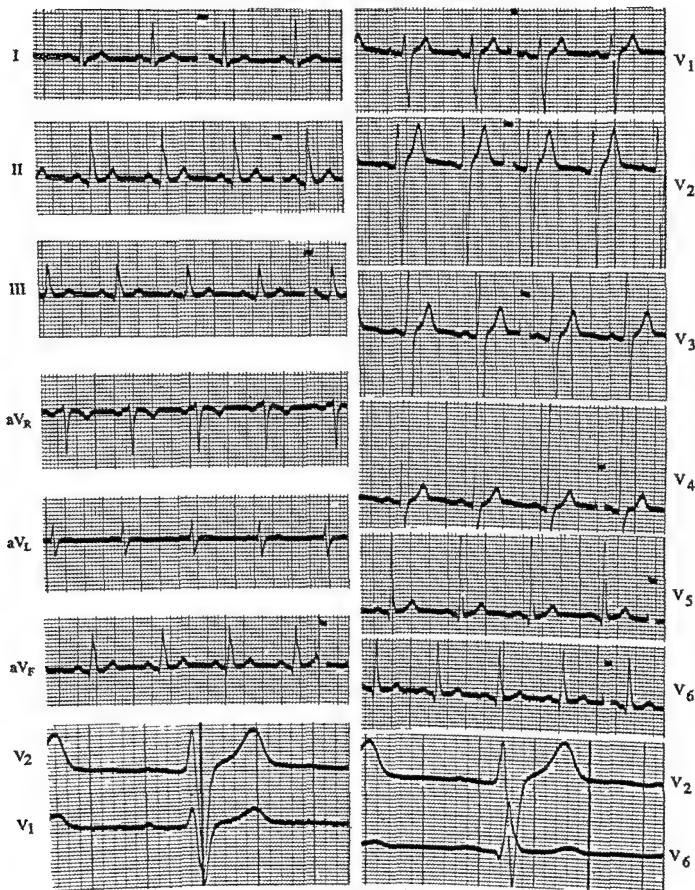


I The first portion of the QRS complexes in lead V₆ is

- A large and positive
- B isoelectric or slightly positive
- C negative

II The transitional zone (QRS complexes) is at lead

- | | |
|------------------|------------------|
| A V ₁ | D V ₄ |
| B V ₂ | E V ₅ |
| C V ₃ | |

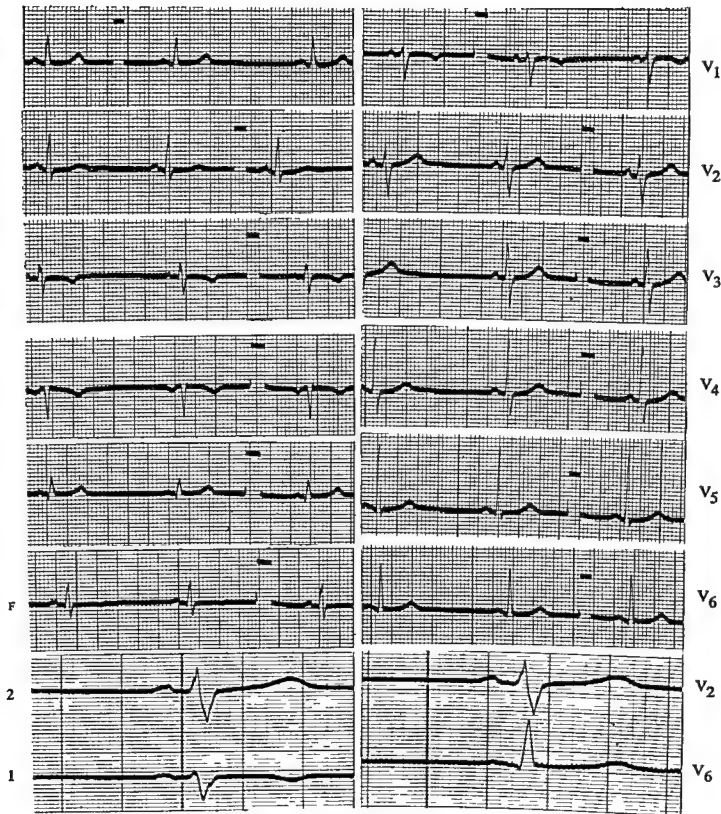


I The mean electric axis of the QRS complexes is

- A deviated abnormally to the right
- B deviated abnormally to the left
- C within normal limits

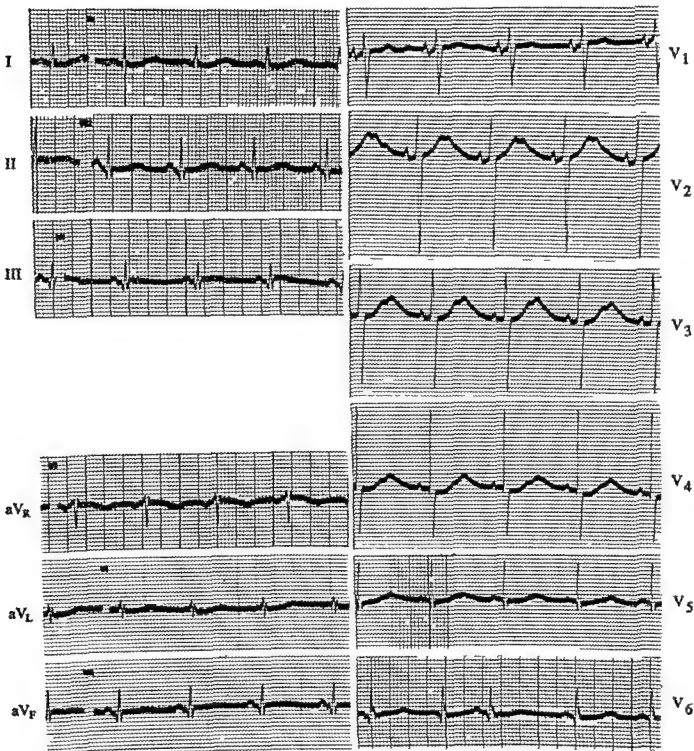
II The tracing is

- A definitely abnormal
- B normal



A possible cause for the cardiac rhythm which is present is

- A anemia
- B anxiety
- C hyperthyroidism
- D infection
- E epinephrine
- F reserpine

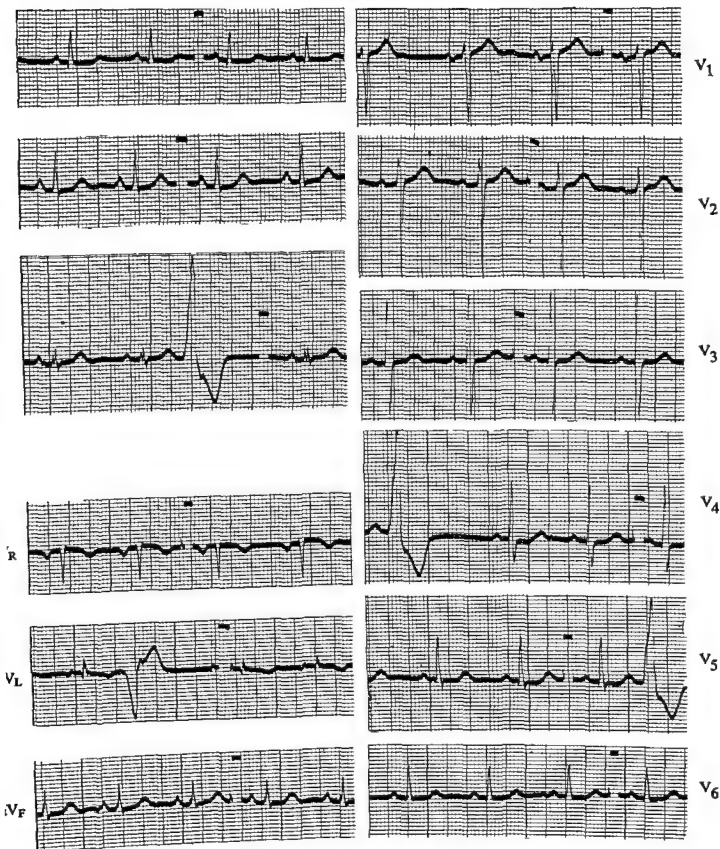


I The electrocardiogram suggests the following (select one)

- A quinidine effect
- B quinidine effect and muscle tremor in the limbs
- C quinidine effect muscle tremor in the limbs and a loose connection to the lamp circuit in the electrocardiograph machine
- D 60 cycle alternating current interference

II The electrocardiographic position of the heart is

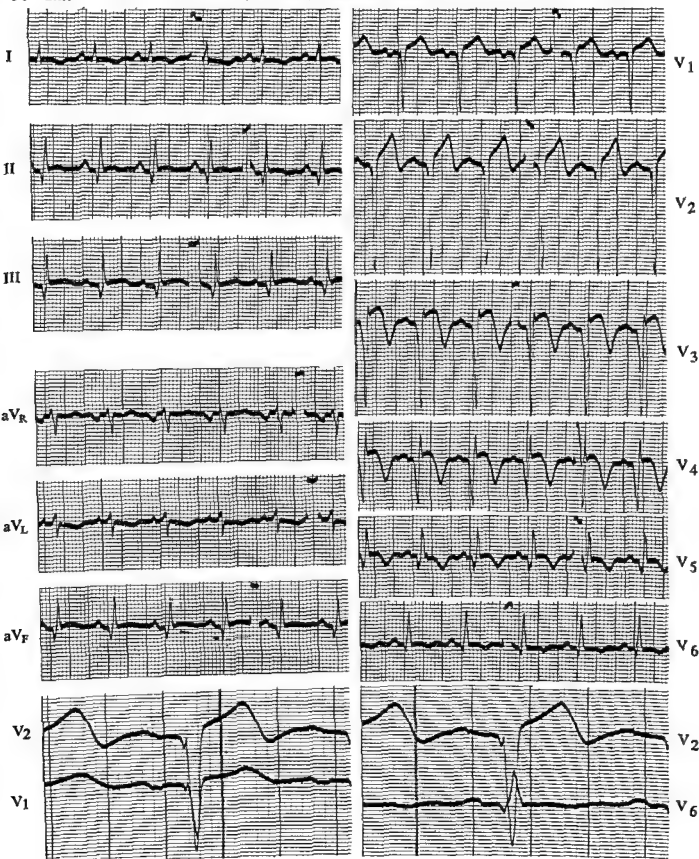
- | | |
|------------------|-----------------|
| A. horizontal | D vertical |
| B semihorizontal | E semivertical |
| C intermediate | F indeterminate |



The following is present

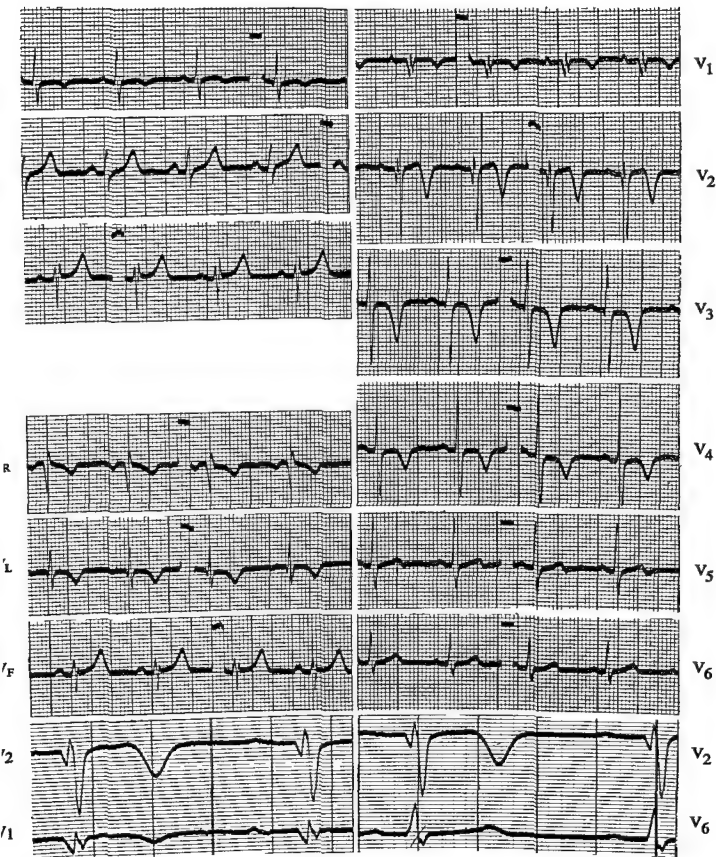
- A atrial premature contractions with aberration
- B ventricular premature contractions
- C nodal premature contractions without retrograde conduction
- D nodal premature contractions with retrograde conduction

50 YEAR OLD MALE CHEST PAIN, SEVERE, LASTING TWENTY FOUR HOURS NO CARDIAC DRUGS



The tracing is typical of

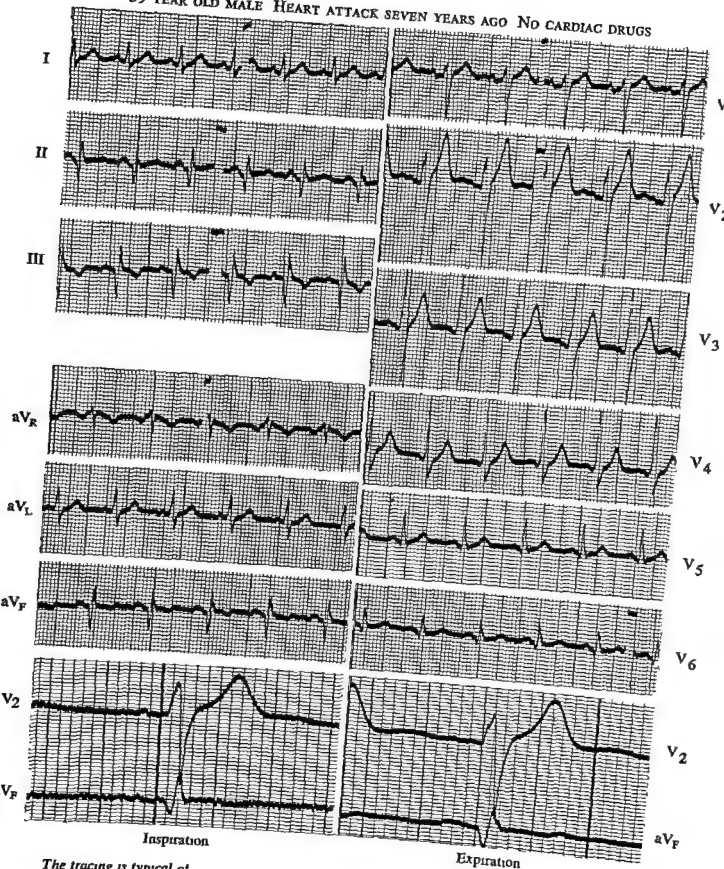
- A acute pericarditis
- B an extensive subacute myocardial infarct
- C pulmonary infarction
- D myocardial ischemia without infarction



An anteroapical myocardial infarct is

- A probable
- B improbable
- C ruled out
- D certain

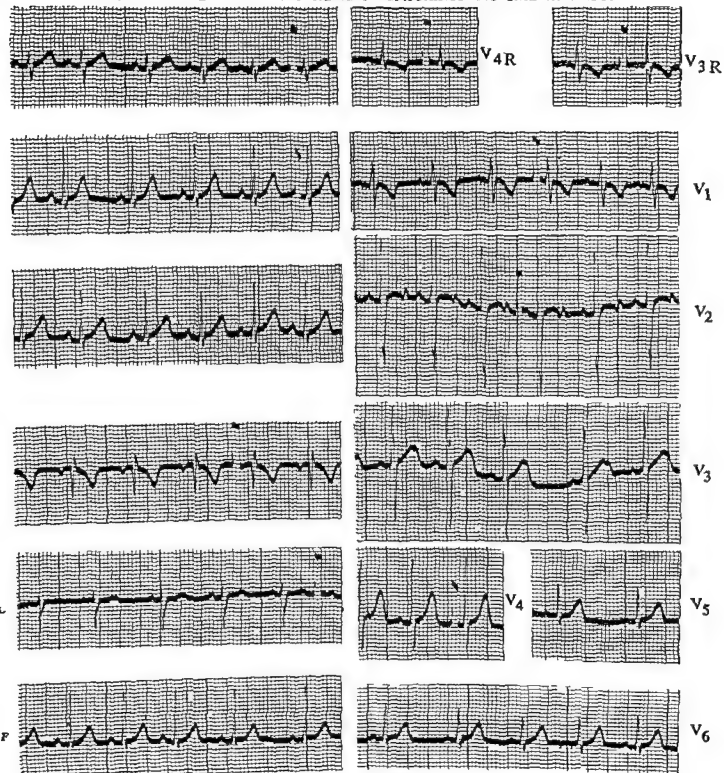
39 YEAR OLD MALE HEART ATTACK SEVEN YEARS AGO NO CARDIAC DRUGS



The tracing is typical of

- A a high lateral myocardial infarct
- B an old anterior myocardial infarct
- C an old posterior myocardial infarct
- D a normal intermediate electrocardiographic position

5 YEAR OLD WHITE FEMALE NO CARDIAC COMPLAINTS NO CARDIAC DRUGS



I The rhythm is

- A sinus tachycardia
- B sinus arrhythmia
- C sinus bradycardia
- D nodal rhythm with retrograde conduction

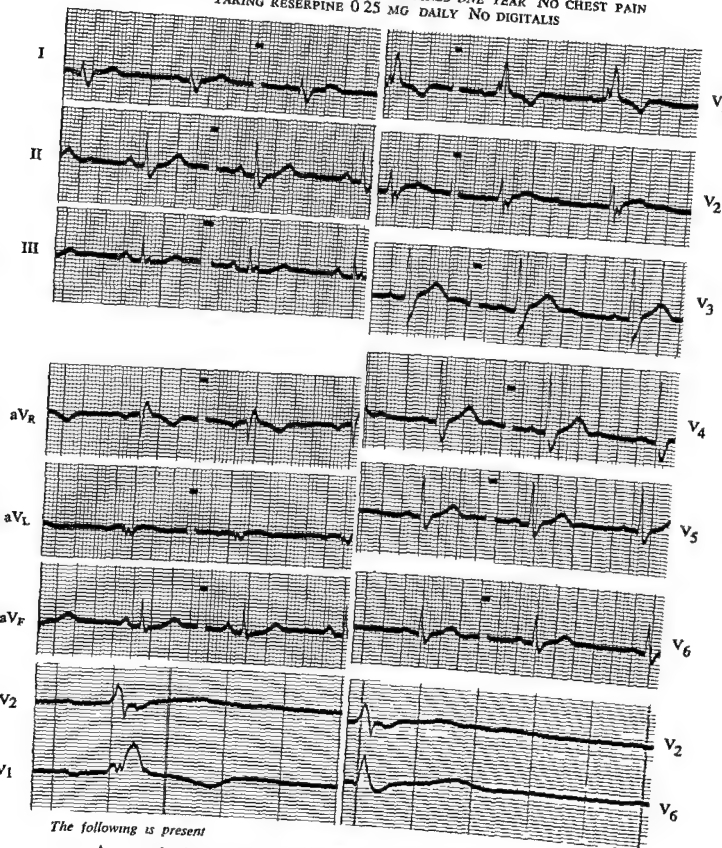
II The tracing

- A indicates right ventricular hypertrophy which is pathologic
- B is within normal limits
- C indicates myocardial ischemia because of the inverted T waves in the precordial leads

III The wandering base line seen in leads V₂ and V₃ suggests

- A a loose connection within the instrument or between a lead wire and the electrode
- B movement of the electrode on the skin or polarization at an electrode
- C 60 cycle interfering alternating current

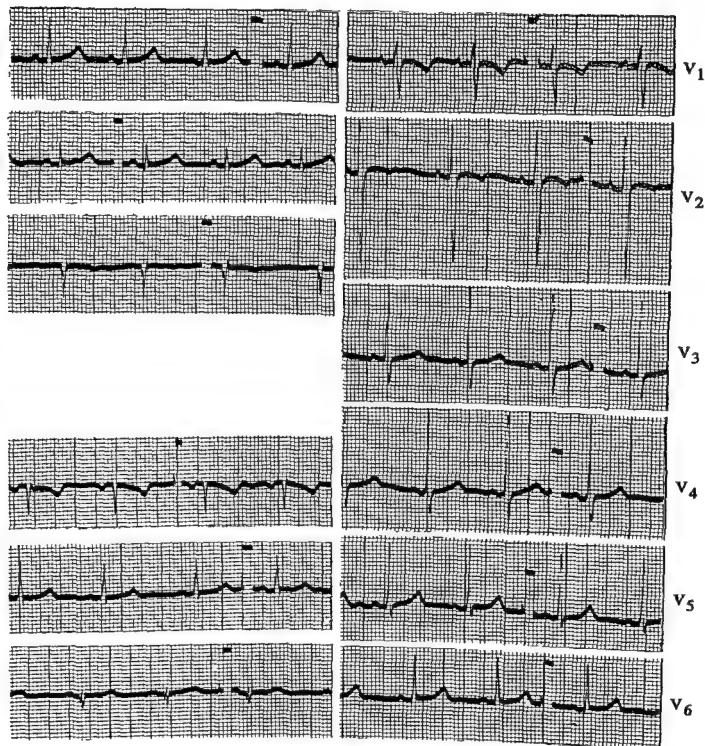
63 YEAR OLD WHITE MALE CLERK HEADACHES ONE YEAR NO CHEST PAIN
TAKING RESERPINE 0.25 MG DAILY NO DIGITALIS



The following is present

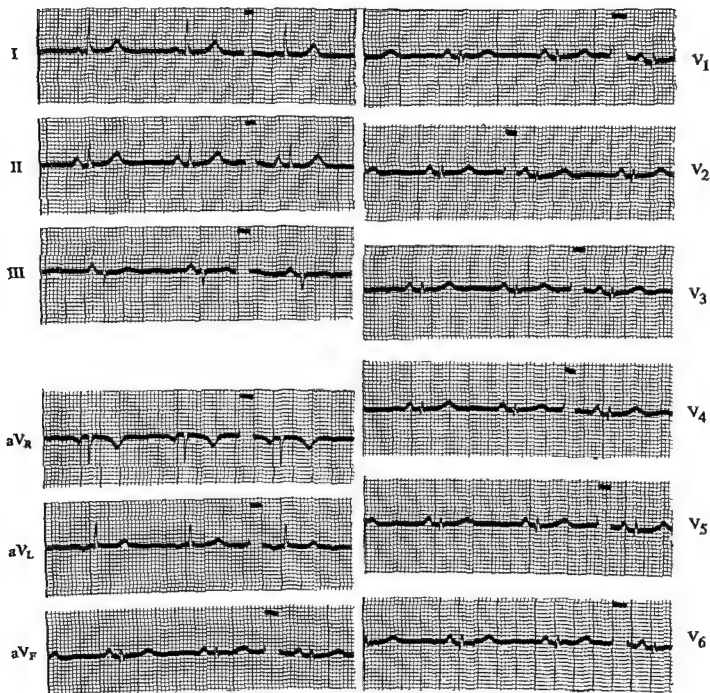
- A sinus bradycardia and a right complete bundle branch block
- B sinus bradycardia and a right incomplete bundle branch block
- C normal sinus rhythm and a right complete bundle branch block
- D a right complete bundle branch block and an anterior infarct

13 YEAR OLD FEMALE CARDIAC CHECK UP NO CARDIAC DRUGS



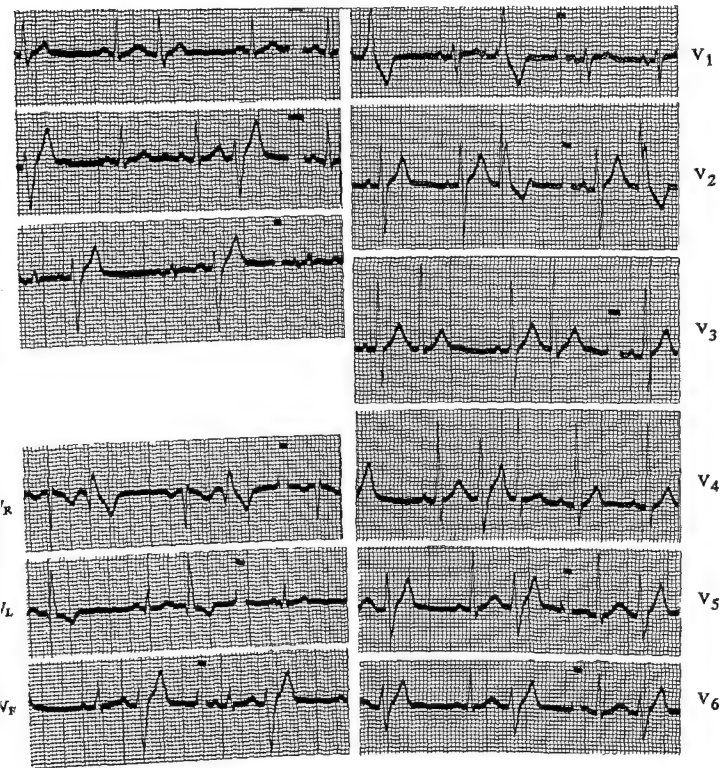
The following artifact is present

- A switching of the lead I wires when the electrodes were applied to the right and left arms of the patient
- B switching of the lead II wires when the right arm and left leg electrodes were applied to the patient
- C switching of the lead III wires when the left arm and left leg electrodes were applied to the patient



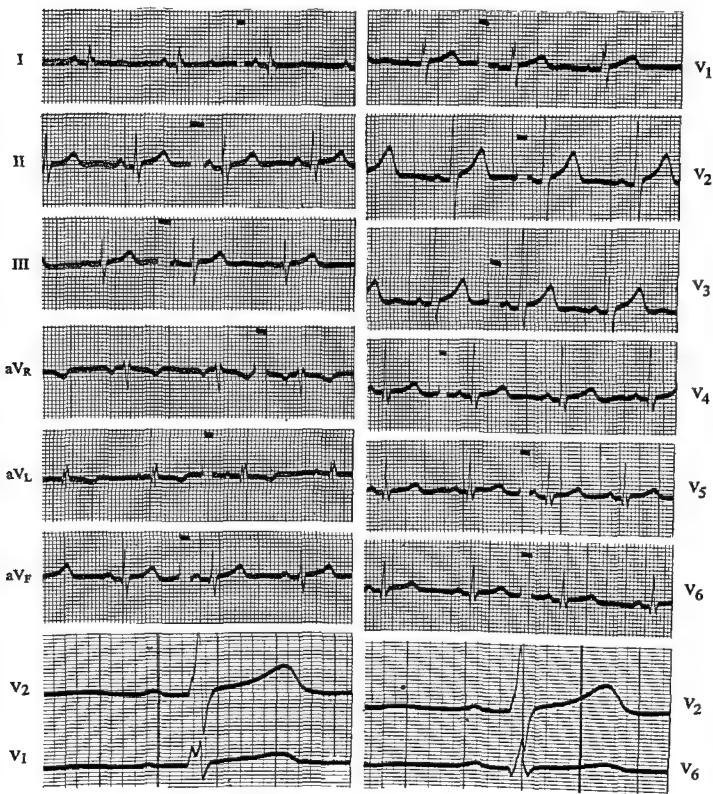
The following is present

- A no artifact
- B definite evidence of a posterior myocardial infarct
- C an artifact involving some of the unipolar leads (V leads)
- D nodal rhythm



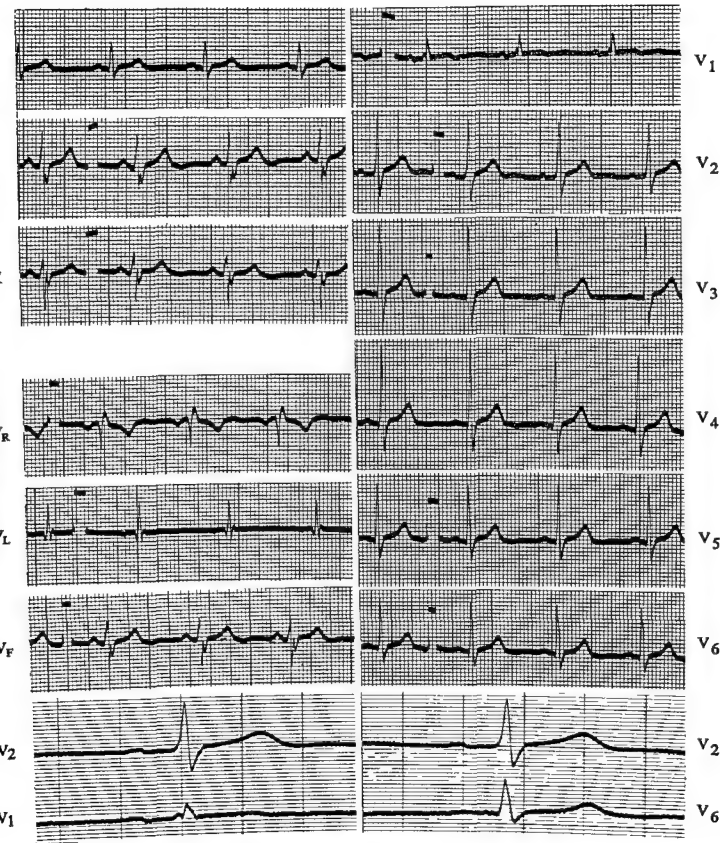
The following is present

- A atrial premature contractions with aberration of the QRS complexes
- B multiple ventricular premature contractions
- C multifocal ventricular premature contractions
- D a paroxysmal left bundle branch block in the absence of premature atrial contractions



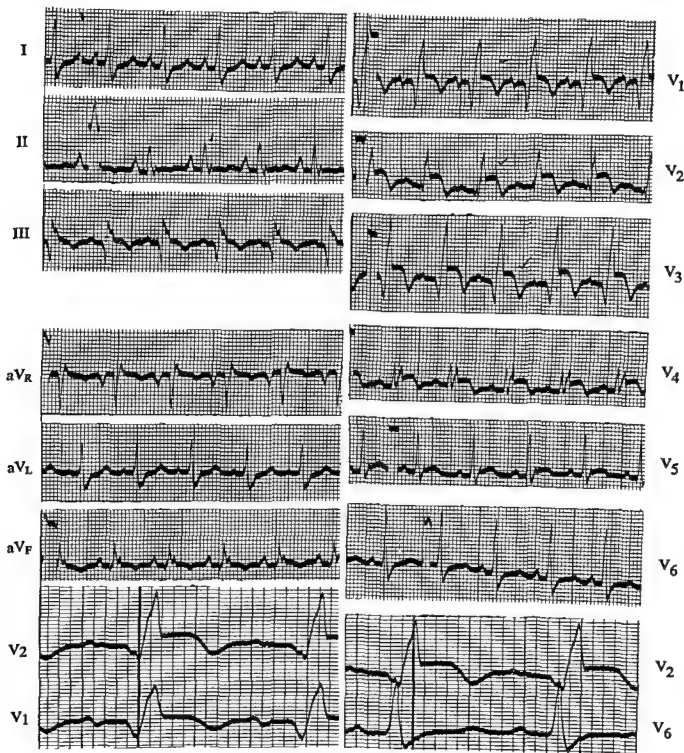
The electrocardiogram

- A is diagnostic of a myocardial infarct
- B rules out a myocardial infarct
- C is in keeping with a diagnosis of a myocardial infarct



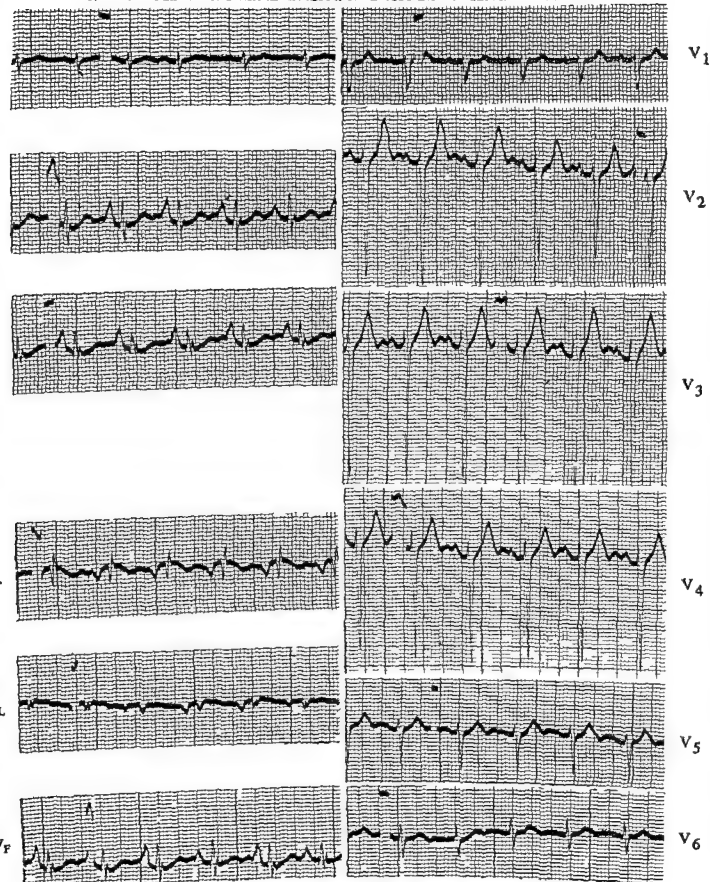
The tracing is in keeping with

- A a complete right bundle branch block
- B an incomplete right bundle branch block
- C no cardiac disease
- D an incomplete left bundle branch block



The following is present

- A a right incomplete bundle branch block
- B a right complete bundle branch block and a myocardial infarct
- C a right complete bundle branch block and left ventricular hypertrophy
- D a right complete bundle branch block and right ventricular hypertrophy

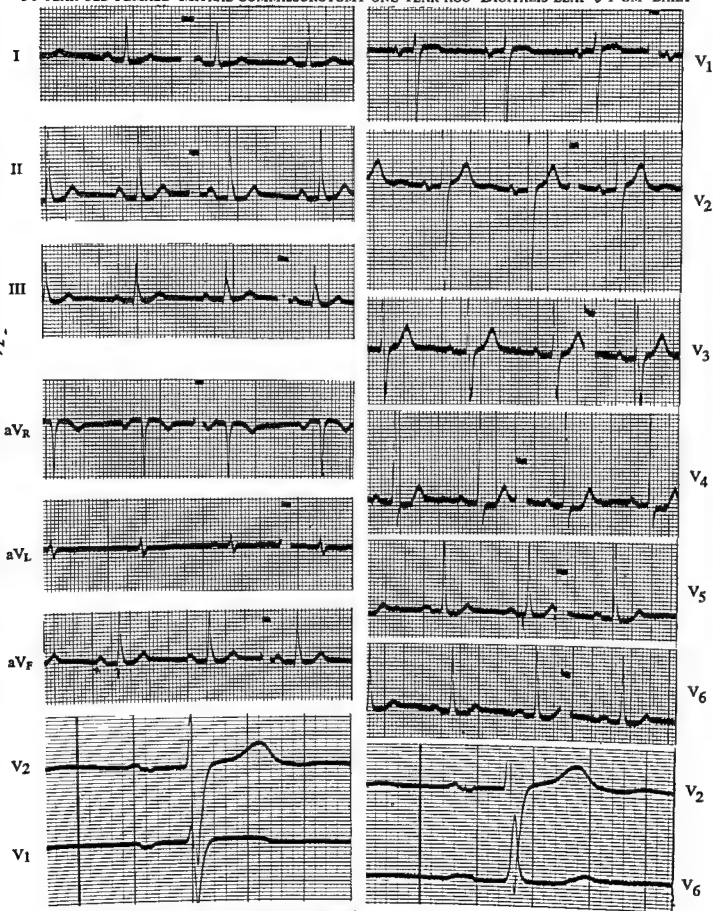


I The P wave picture is that of

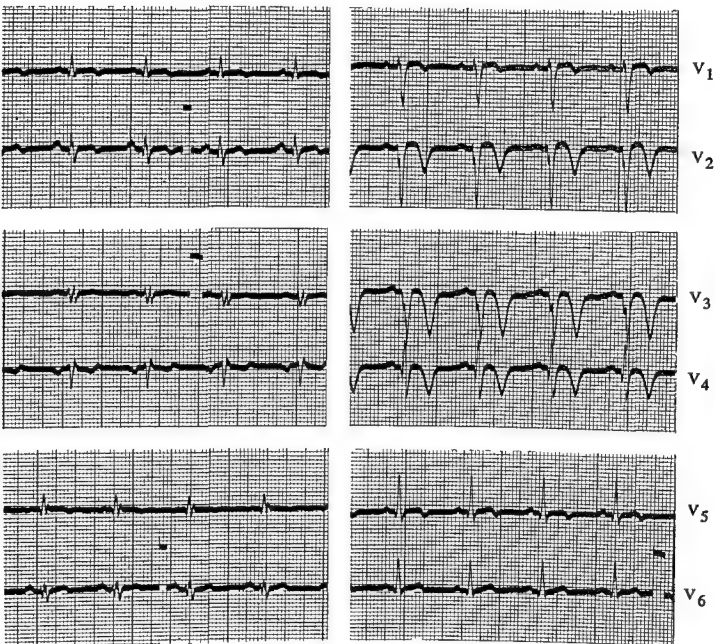
- A P mitrale
- B P pulmonale
- C normal atria

II The clinical conditions which produce tracings of this sort are

- A acute cor pulmonale
- B chronic cor pulmonale
- C mitral stenosis

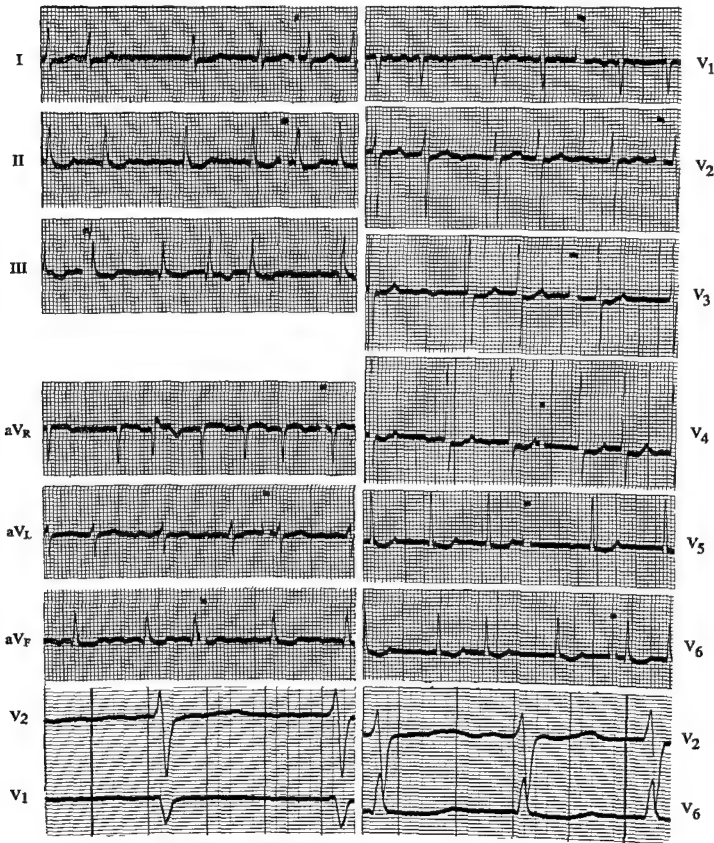


The tracing
 A rules out rheumatic mitral stenosis
 B is in keeping with a digitalis effect
 C suggests pericarditis



The tracing has the characteristics of

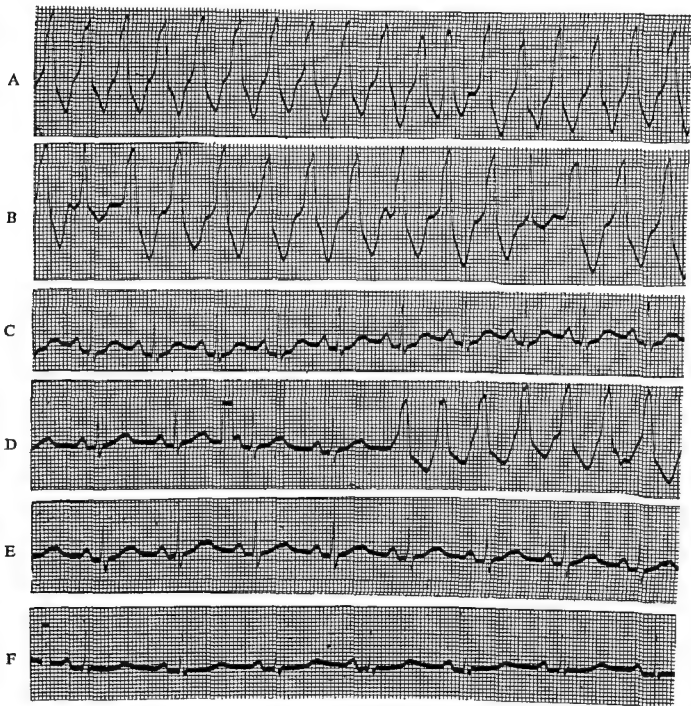
- A an acute (few hours) anterolateral myocardial infarct
- B a subacute or chronic anteroapical myocardial infarct
- C anterior myocardial ischemia without infarction
- D an anterior and posterior myocardial infarct



The tracing is most consistent with heart disease due to

- A hyperthyroidism
- B syphilis
- C ventricular septal defect
- D hypothyroidism

55 YEAR OLD MALE ATTACKS OF WEAKNESS, SWEATING AND PRECORDIAL PAIN INTERMITTENTLY
FOR ONE YEAR ALL TRACINGS ARE LEAD II



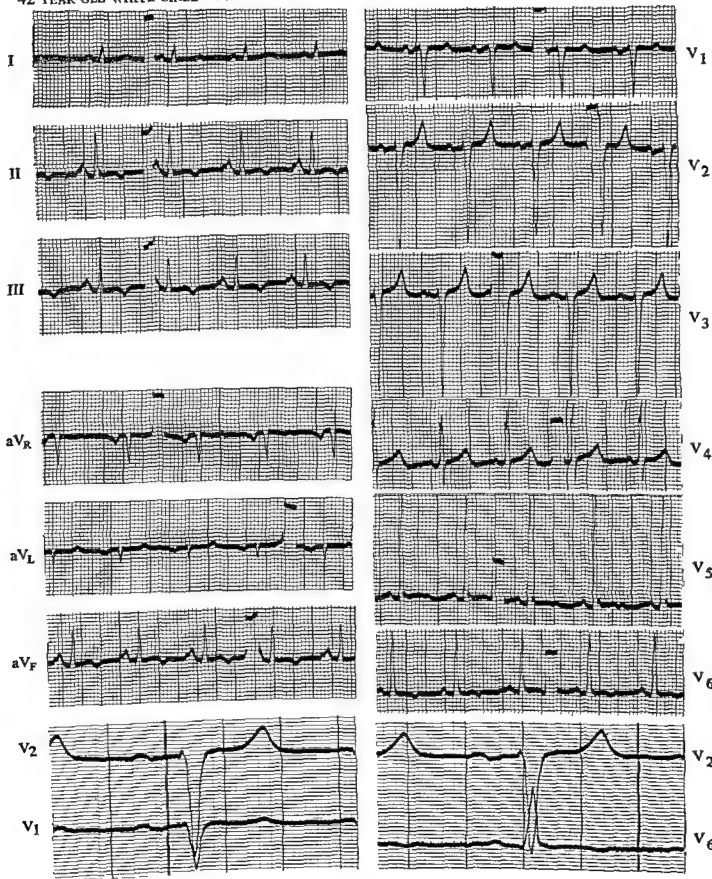
I The cardiac rhythm shown in tracing A is

- A ventricular fibrillation
- B ventricular flutter
- C ventricular tachycardia
- D anomalous atrioventricular conduction
(Wolff Parkinson White)

II Tracing F shows a normal sinus rhythm and suggests

- A digitalis effect
- B hyperkalemia
- C hypercalcemia
- D quinidine

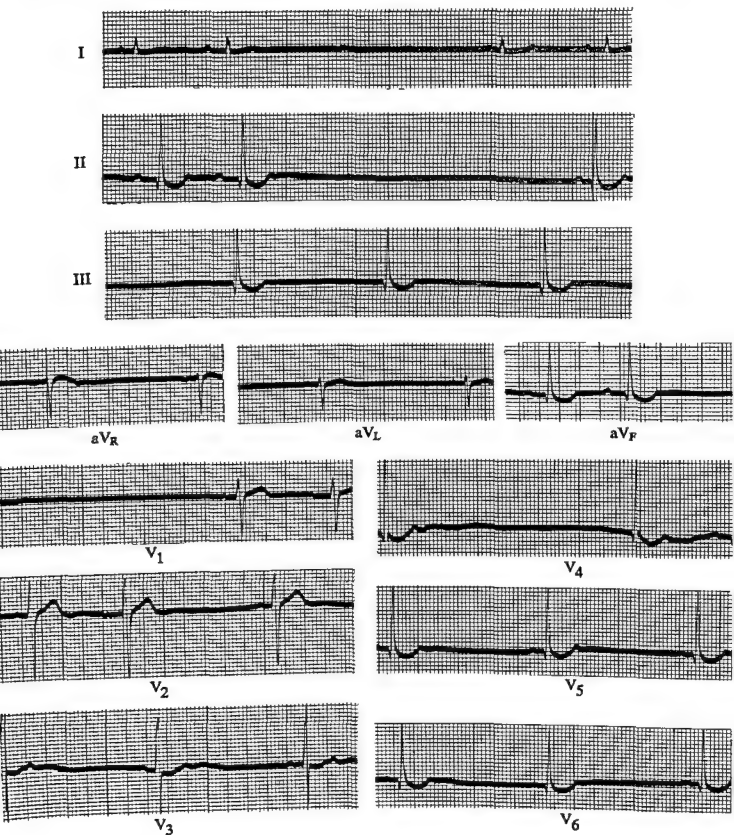
42 YEAR OLD WHITE MALE BOOKKEEPER LEFT CHEST PAIN ON EFFORT FOR TWENTY FIVE YEARS



The electrocardiogram is

- A within normal limits
- B diagnostic of coronary artery disease
- C strongly suggestive of pulmonary embolus
- D consistent with chronic adhesive or constrictive pericarditis

40 year old WHITE FEMALE BLACK OUT SPELLS AND SHORTNESS OF BREATH
TAKING DIGITALIS, RESERPINE AND QUINIDINE RHEUMATIC FEVER AND CHOREA AS A CHILD

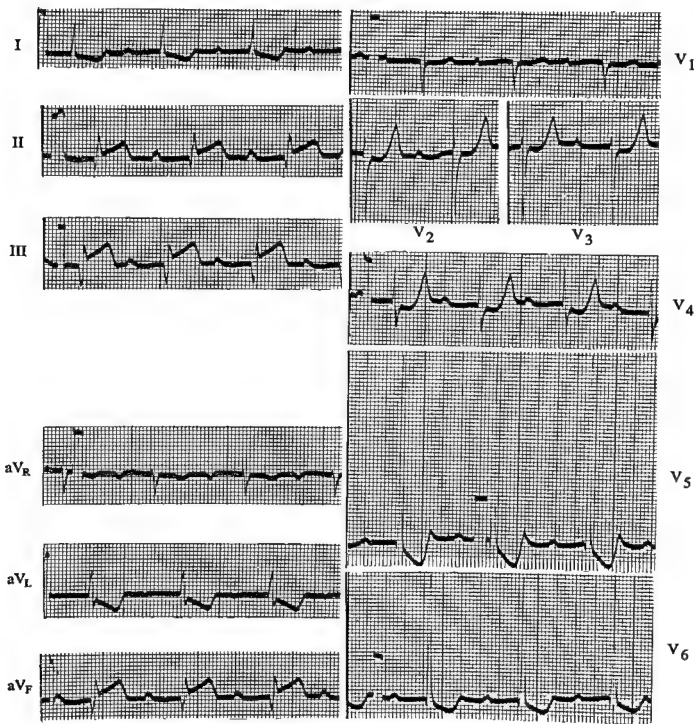


I The tracing shows

- A periods of sinus arrest
- B nodal bradycardia
- C slow atrial fibrillation
- D Wenckebach phenomena

II The tracing shows the effect of

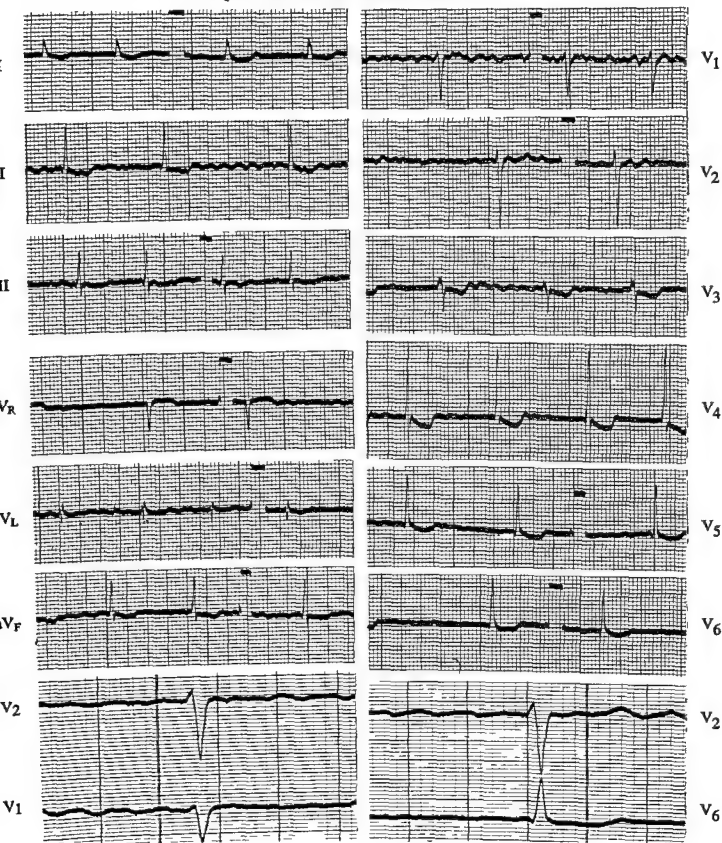
- A quinidine
- B digitalis



The following is present

- A an incomplete AV block without dropped beats (first degree) without other abnormalities
- B an incomplete AV block without dropped beats with an acute posterior myocardial infarct but without ventricular hypertrophy
- C an incomplete AV block without dropped beats with an acute posterior myocardial infarct with left ventricular hypertrophy

62 YEAR OLD FEMALE SHORTNESS OF BREATH ON EXERTION DIGITALIS LEAF 0.1 GM DAILY
AND QUINIDINE 0.2 GM THREE TIMES DAILY

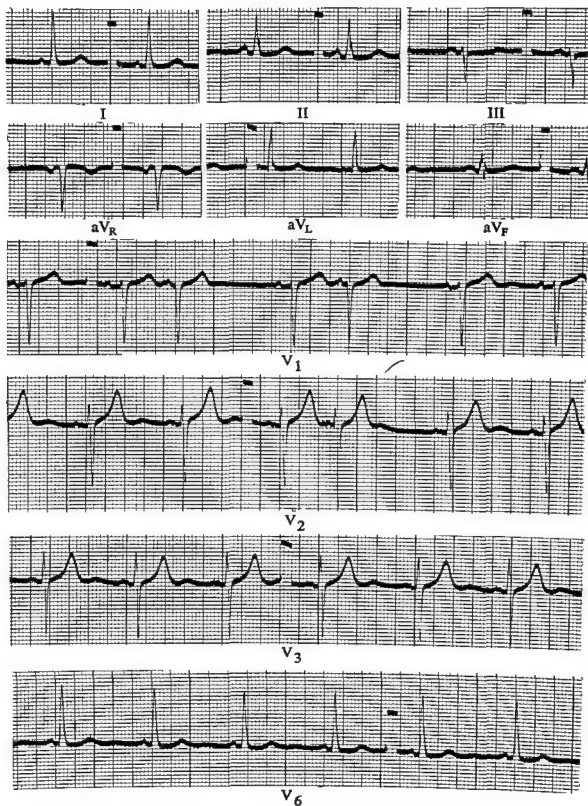


I The rhythm is

- A atrial fibrillation
- B atrial flutter
- C a complete AV block with nodal rhythm
- D atrial premature contractions

II The tracing suggests

- A quinidine administration
- B digitalis administration
- C myocardial infarction
- D right ventricular hypertrophy

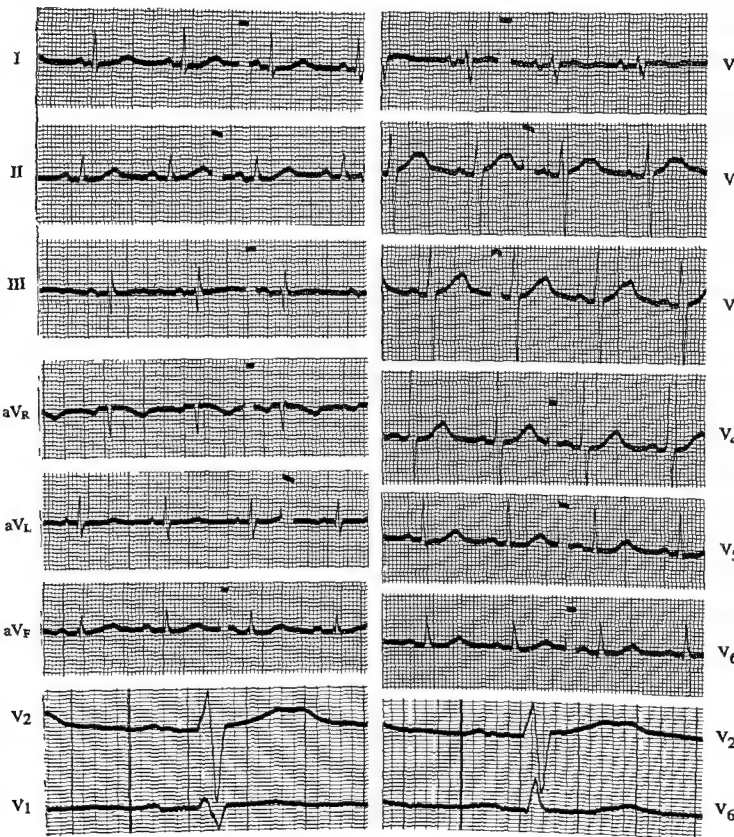


I The cardiac irregularity is

- A atrial premature contractions
- B nodal premature contractions
- C septal ectopic beats
- D ventricular extrasystoles

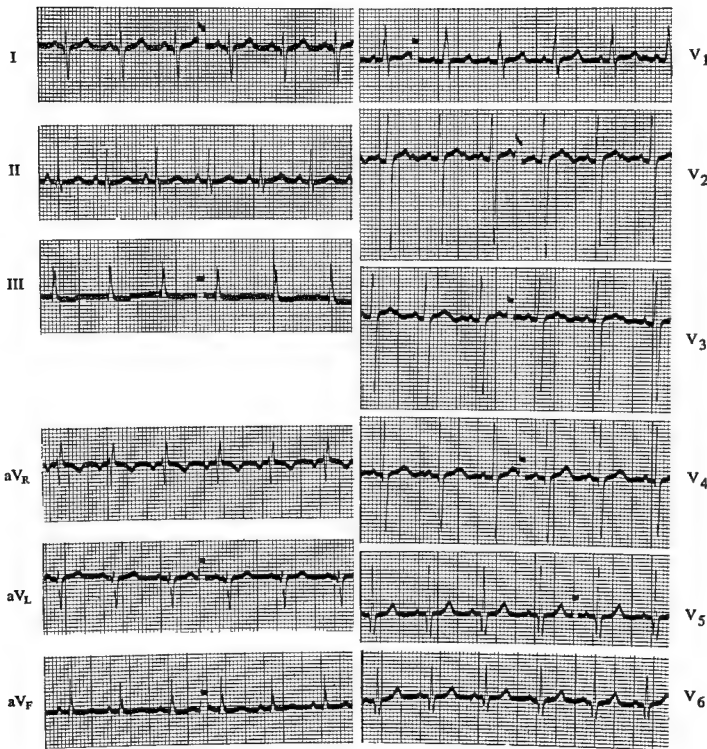
II The tracing is most consistent with

- A left ventricular hypertrophy
- B right ventricular hypertrophy



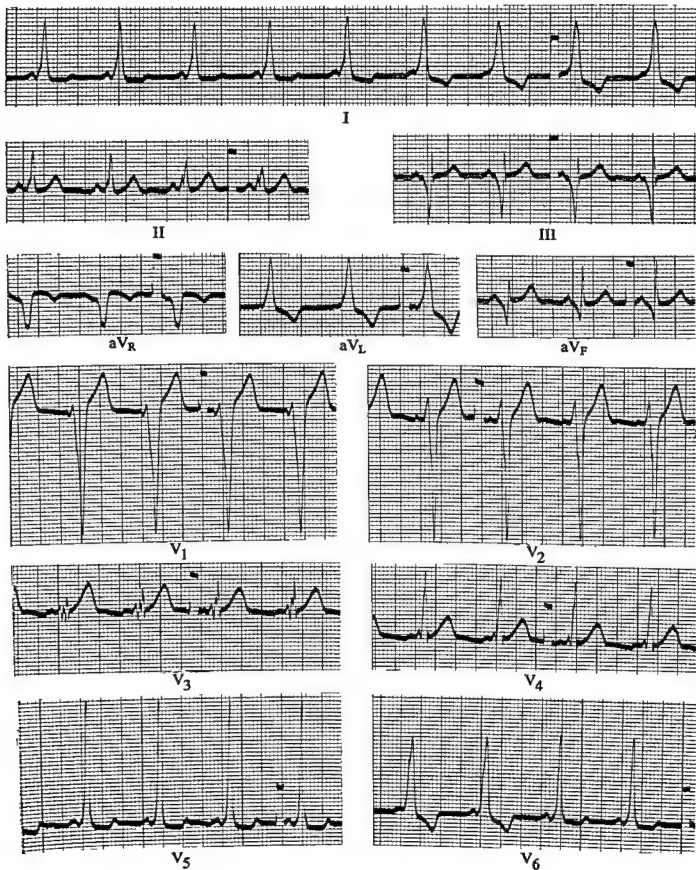
The electrocardiogram is

- A normal
- B suggestive of quinidine procaine amide administration or hypocalcemia
- C typical of digitalis administration
- D typical of hyperpotassemia



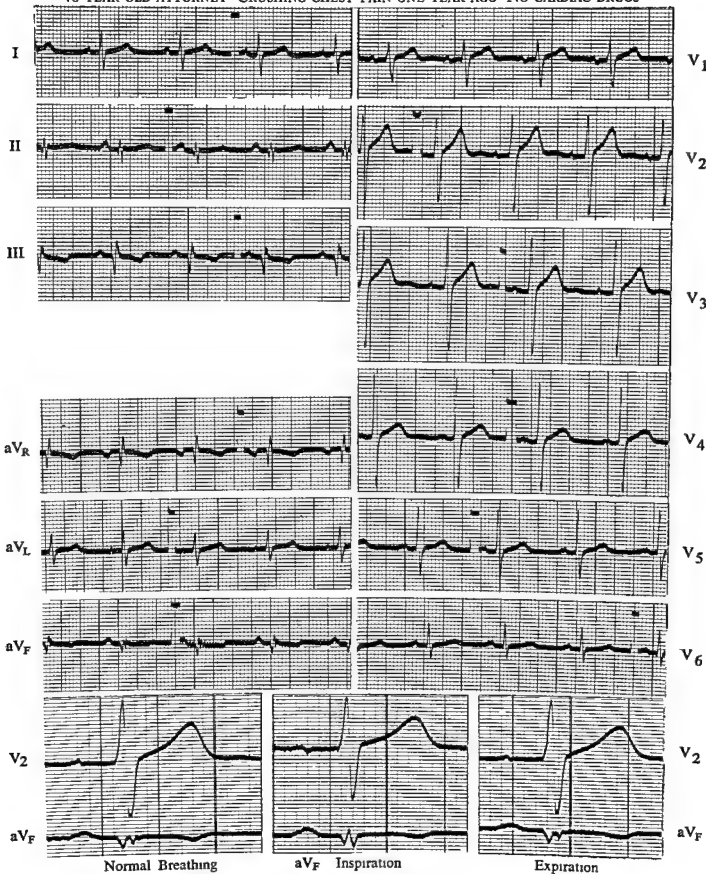
The electrocardiogram suggests

- A right ventricular hypertrophy
- B no cardiac hypertrophy
- C a complete right bundle branch block
- D an acute pulmonary embolism



The tracing indicates the presence of

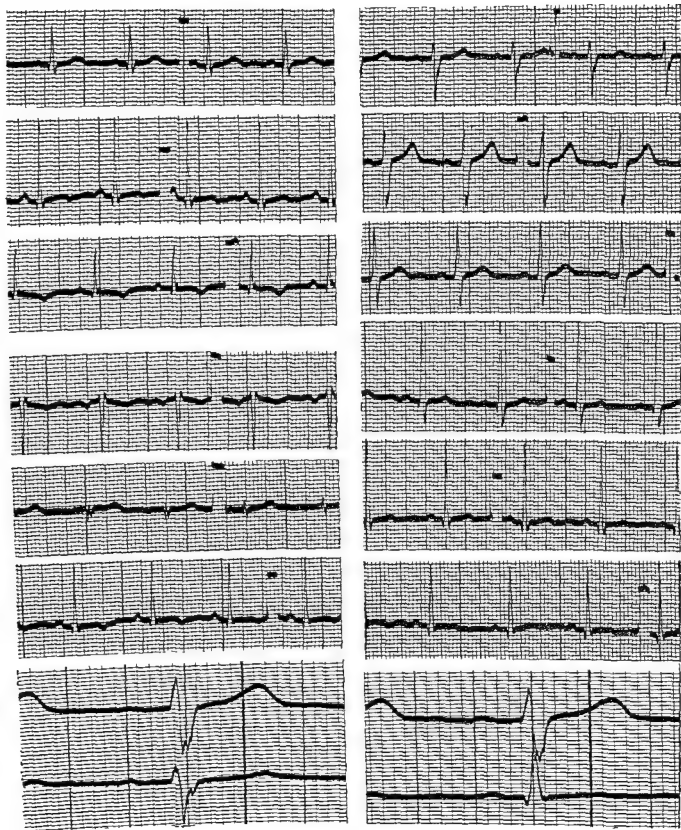
- A a complete left bundle branch block
- B a complete and incomplete left bundle branch block
- C an incomplete left bundle branch block
- D an anomalous atrioventricular conduction (Wolff Parkinson White)



The electrocardiogram

- A has a normal vertical electrocardiographic position
- B rules out a posterior infarct
- C is in keeping with a posterior infarct
- D has a normal semivertical ele.

37 YEAR OLD MALE CHEST PAIN ON EFFORT, THREE MONTHS



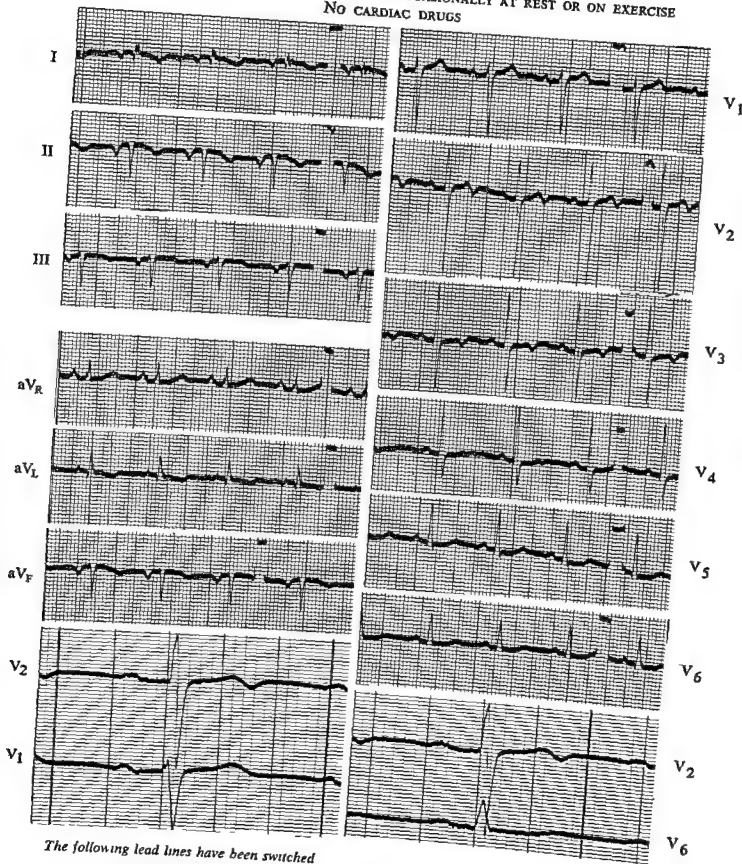
I The electrocardiographic position is

- A vertical
- B semivertical
- C intermediate
- D semihorizontal
- E horizontal
- F indeterminate

II The tracing suggests

- A anteroapical myocardial ischemia
- B posterior myocardial ischemia
- C posterior myocardial infarct
- D septal infarct

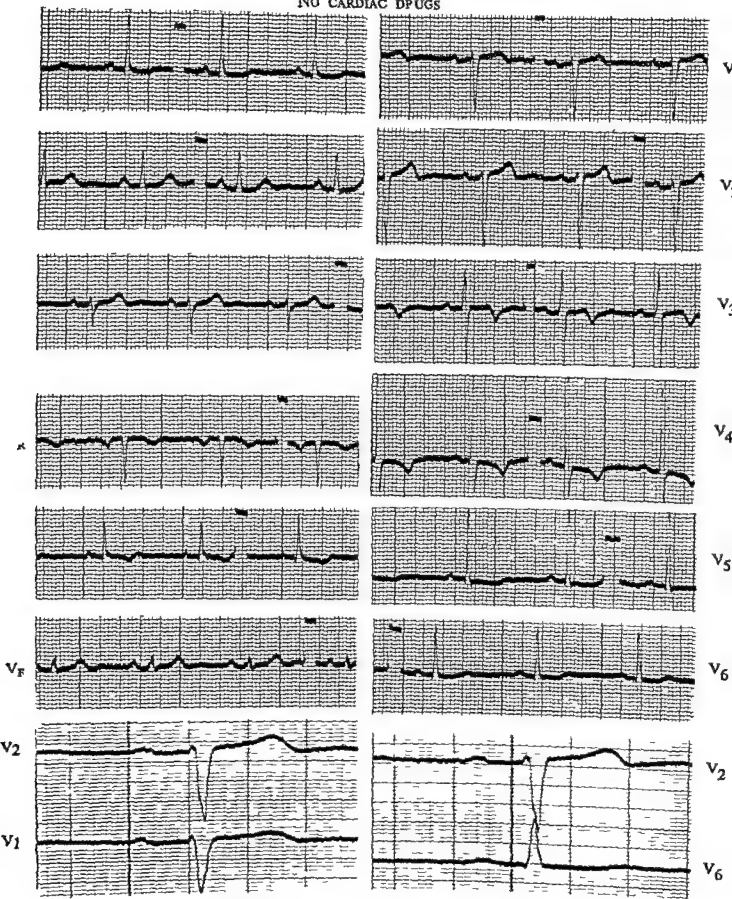
48 YEAR OLD WHITE MALE CHEST PAIN OCCASIONALLY AT REST OR ON EXERCISE
NO CARDIAC DRUGS



The following lead lines have been switched

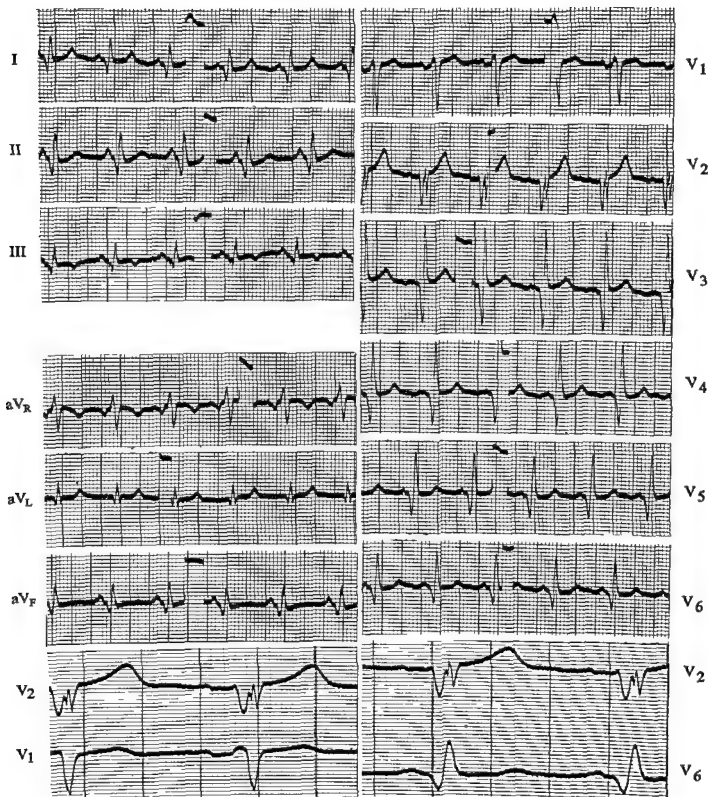
- A lead I (right arm and left arm) wires when attached to the arms
- B lead II (right arm and left leg) wires when attached to the right arm and left leg
- C lead III (left arm and left leg) wires when attached to the left arm and left leg

72 YEAR OLD WHITE MALE PHYSICIAN MINIMAL CHEST PAIN LASTING THREE MINUTES
NO CARDIAC DRUGS



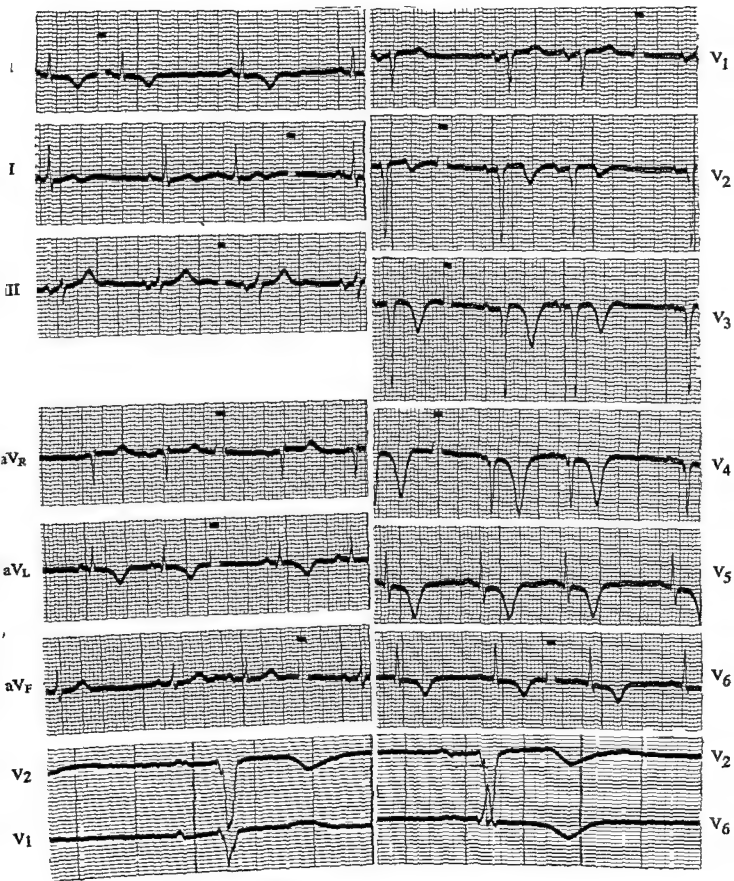
The electrocardiogram is suggestive of

- A ischemia involving the anterior wall of the left ventricle
- B ischemia involving the posterior wall of the left ventricle
- C ischemia involving the posterior and anterior wall of the left ventricle



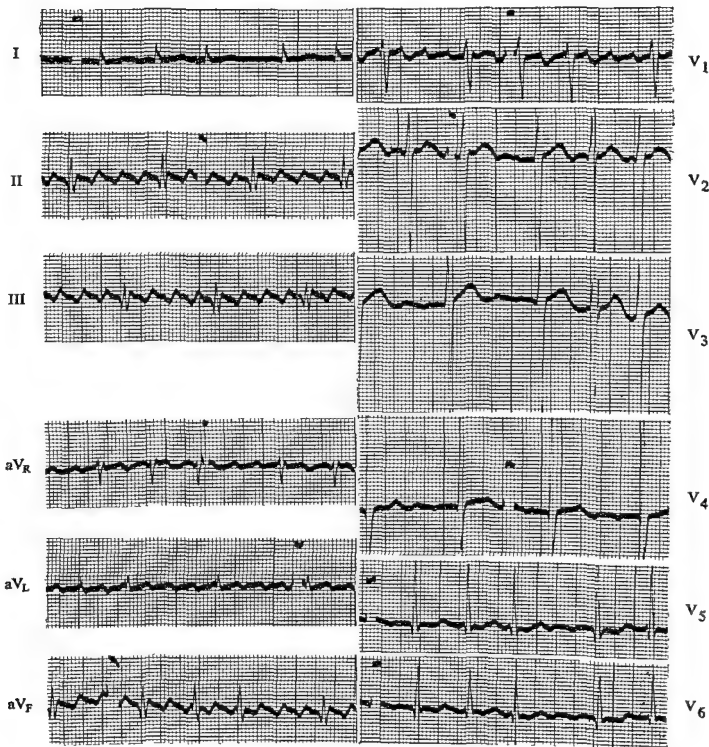
The tracing indicates the presence of

- A an incomplete left bundle branch block
- B an anterior and a posterior myocardial infarct
- C an intraventricular block without a myocardial infarct
- D an acute anterior and an acute posterior myocardial infarct



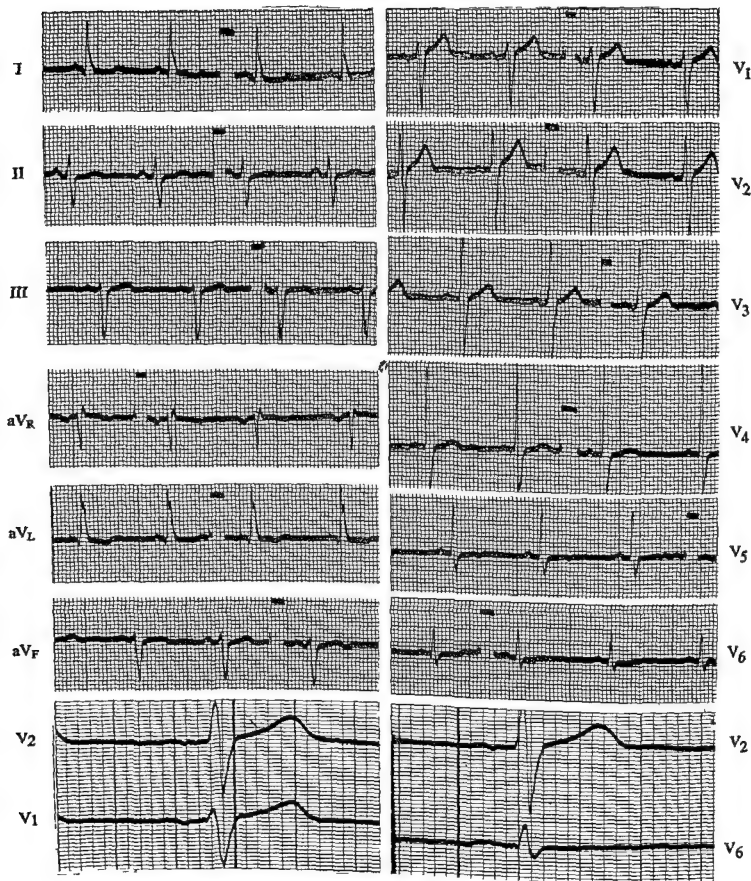
The tracing indicates the presence of

- A anterior myocardial ischemia without myocardial infarction
- B anterolateral myocardial infarction without other abnormalities
- C anterolateral myocardial infarction with atrial premature contractions
- D left ventricular hypertrophy



The rhythm is

- A atrial fibrillation
- B atrial flutter
- C interference dissociation
- D nodal tachycardia

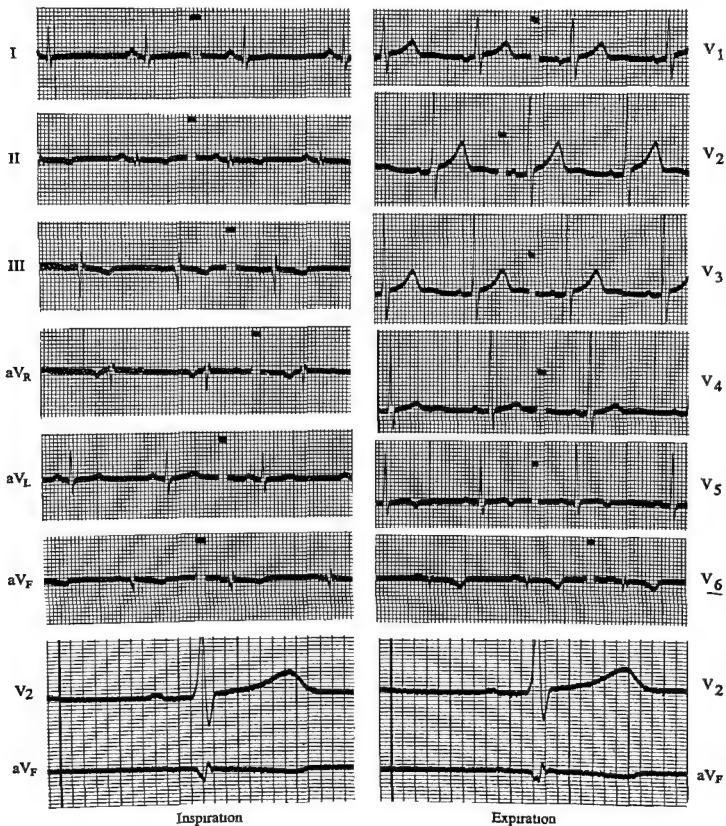


I The electric axis of the QRS complexes is

- A deviated to the right
- B deviated to the left
- C within normal limits

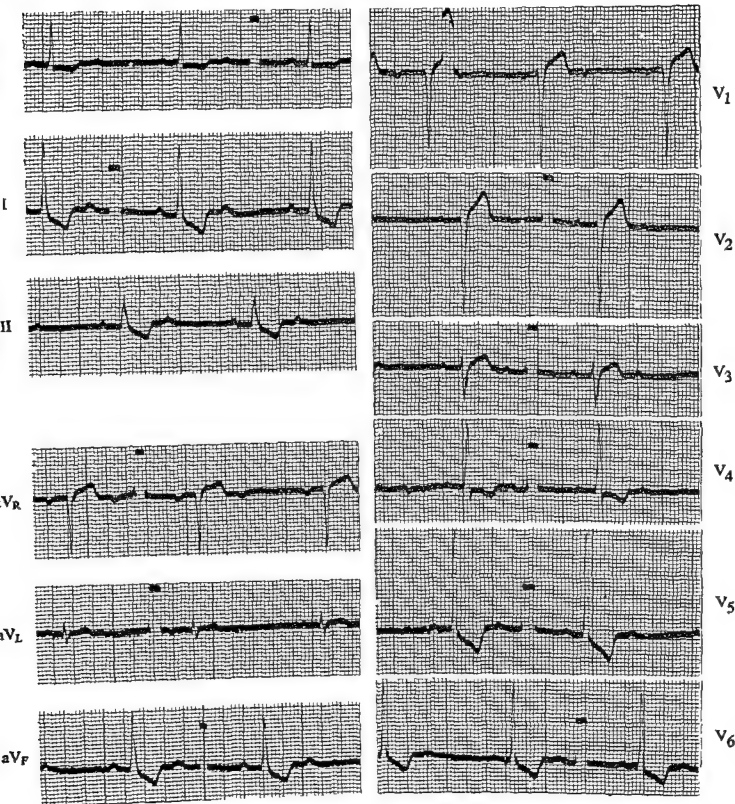
II Other abnormalities are

- A not present
- B present



The tracing indicates the presence of

- A an old (more than a month) posterior infarct with posterolateral myocardial ischemia
- B a pulmonary infarct
- C right ventricular hypertrophy
- D a right incomplete bundle branch block



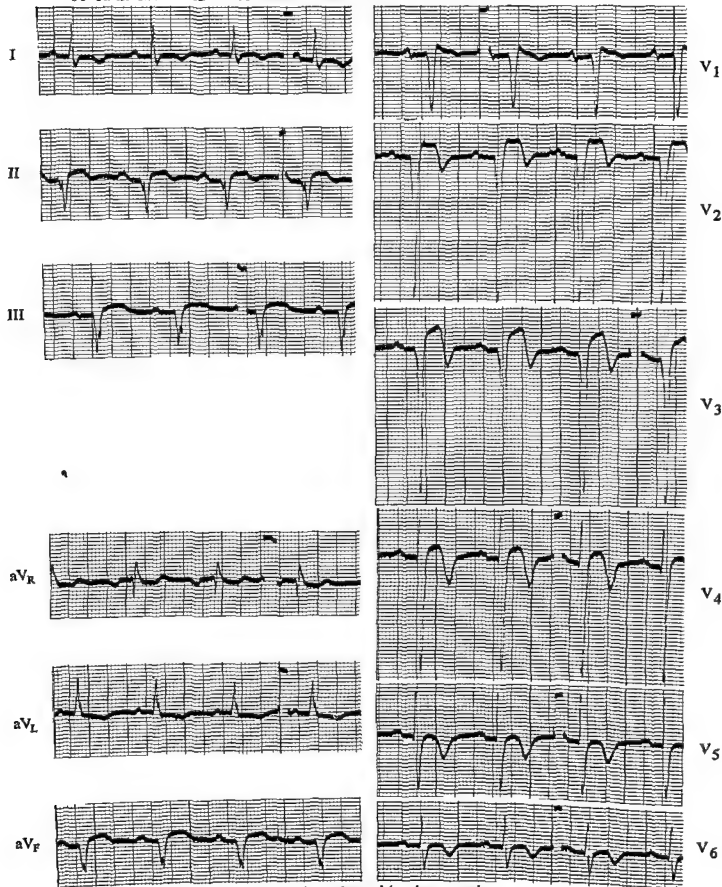
I The rhythm is

- A a 2:1 sino-atrial block
- B atrial premature contractions with an AV block
- C a 2:1 AV block
- D a complete AV block

II The following is present

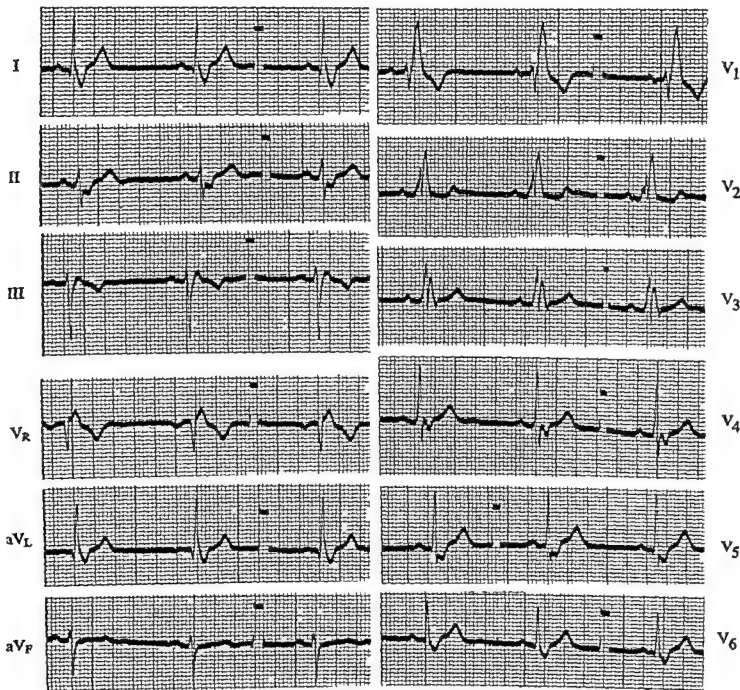
- A left ventricular hypertrophy in the presence of a semivertical heart
- B left ventricular hypertrophy in the presence of an intermediate heart
- C no evidence of left ventricular hypertrophy

60 YEAR OLD MALE SUBSTERNAL PAIN TWO DAYS AGO WHICH LASTED SIX HOURS



If this tracing were to remain essentially unchanged for three months the following diagnosis would be likely

- A chronic pericarditis
- B aortic aneurysm
- C ventricular aneurysm



I The rhythm is

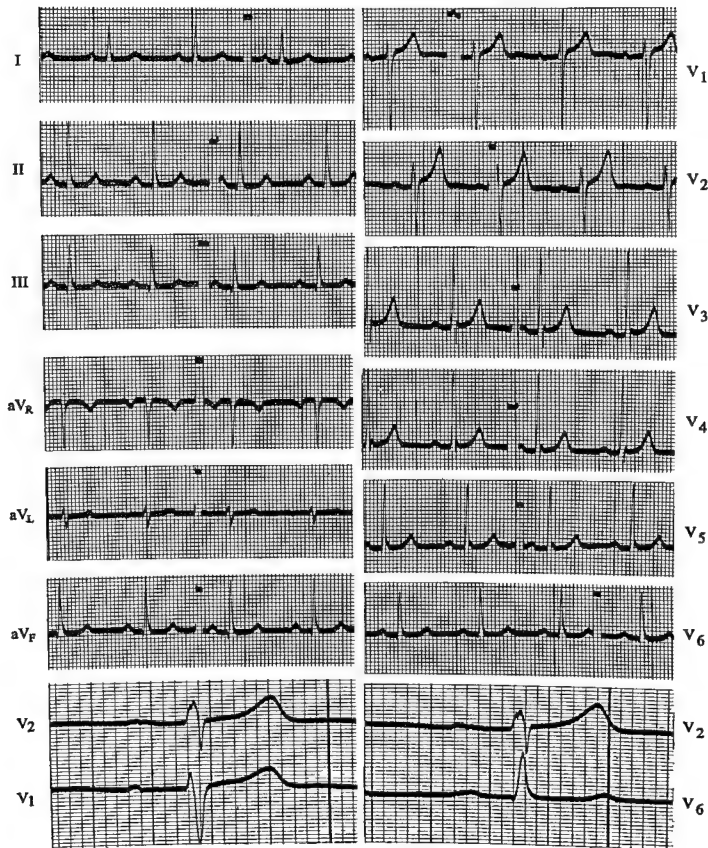
- A sinus bradycardia
- B normal sinus rhythm
- C sinus arrhythmia
- D nodal bradycardia

II The following is present

- A a right incomplete bundle branch block
- B a right complete bundle branch block
- C a left incomplete bundle branch block
- D a left complete bundle branch block

III The electrocardiographic position of the heart is

- A horizontal
- B intermediate
- C vertical

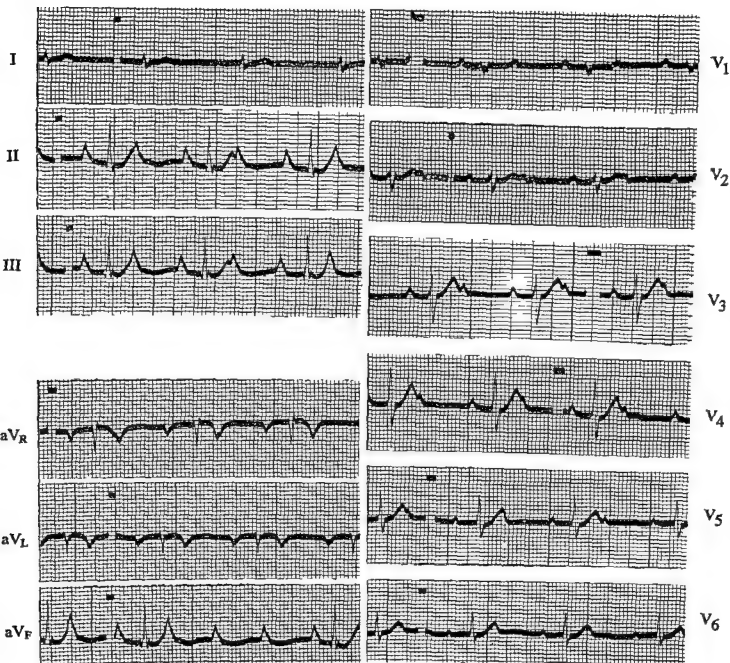


1 The tracing is

- A normal
- B abnormal because of the positive segment shifts in lead V₂
- C abnormal because of the Q waves in leads II III and aV_F

II The electrocardiographic position is

- A semihorizontal
- B horizontal
- C semivertical

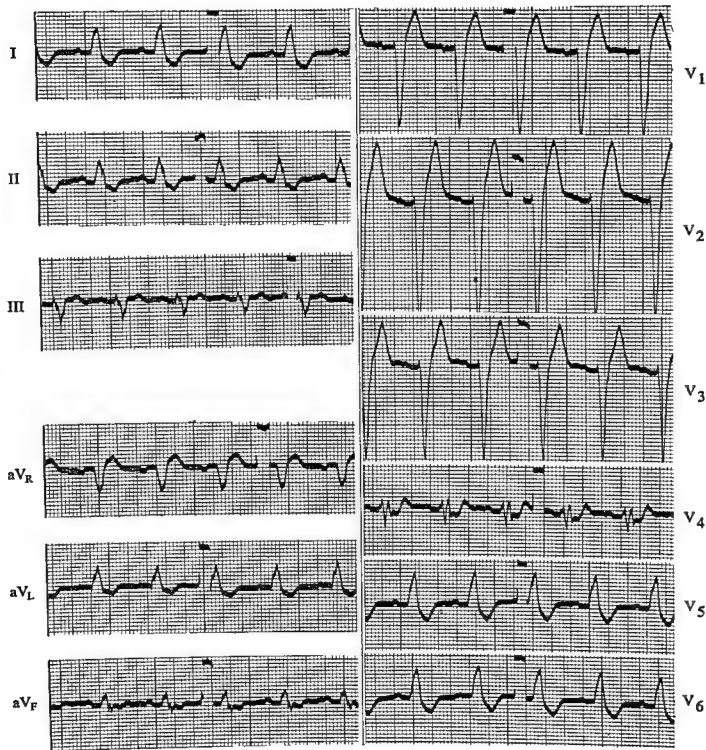


I The rhythm is

- A sinus tachycardia
- B incomplete AV block without dropped beats (first degree)
- ✓C incomplete AV block with dropped beats (second degree)

II The P waves are

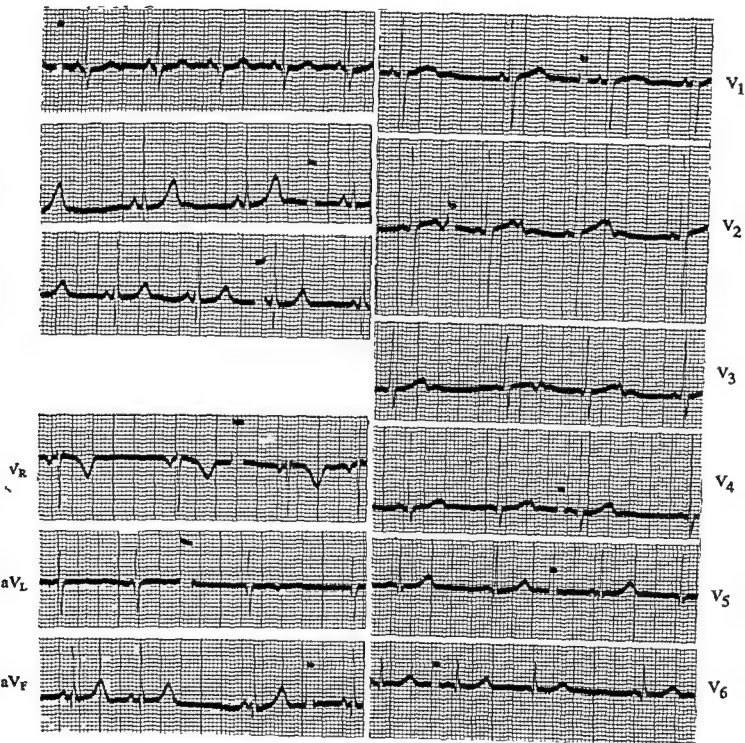
- A entirely normal
- B in keeping with chronic pulmonary disease
- C typical of mitral stenosis



The tracing is typical of

- A a left complete bundle branch block
- B an incomplete left bundle branch block
- C anomalous atrioventricular conduction (Wolff Parkinson White)
- D ventricular tachycardia

8 YEAR OLD BOY SHORTNESS OF BREATH SINCE BIRTH NO DRUGS
(Half Standardization in Precordial Leads)



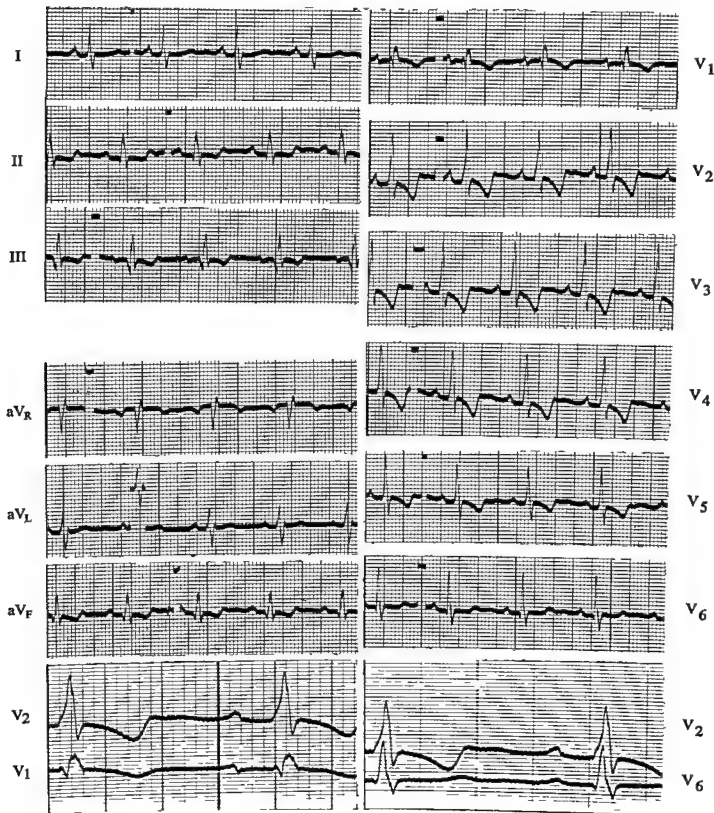
I The electrocardiogram suggests the presence of

- A left atrial enlargement
- B right ventricular hypertrophy
- C a right incomplete bundle branch block
- D right and left ventricular hypertrophy

II The rhythm is

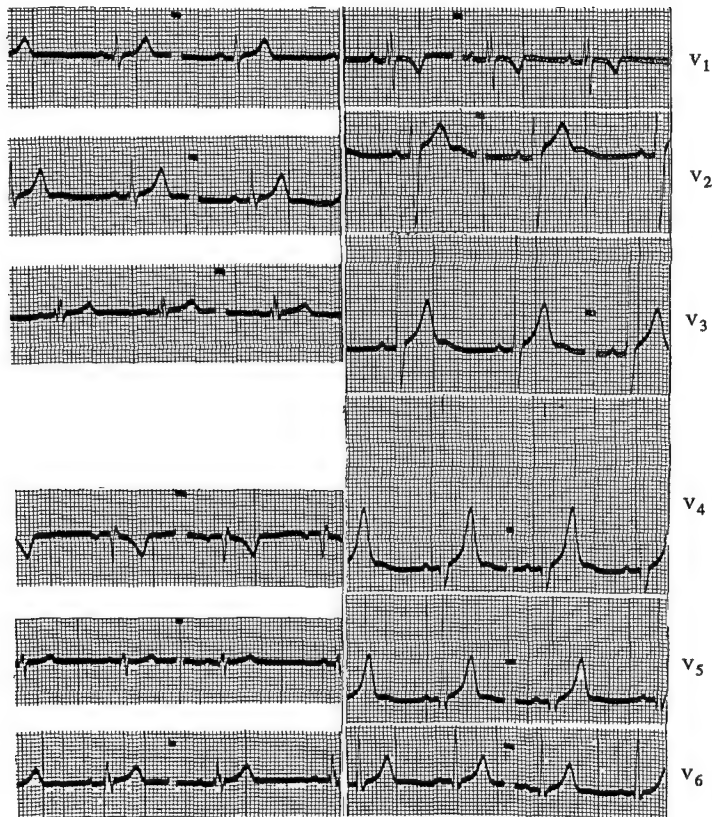
- A sinus tachycardia
- B sinus bradycardia
- C sino atrial block
- D sinus arrhythmia

19 year old female SHORTNESS OF BREATH TEN YEARS TAKING DIGITALIS



The electrocardiogram is consistent with

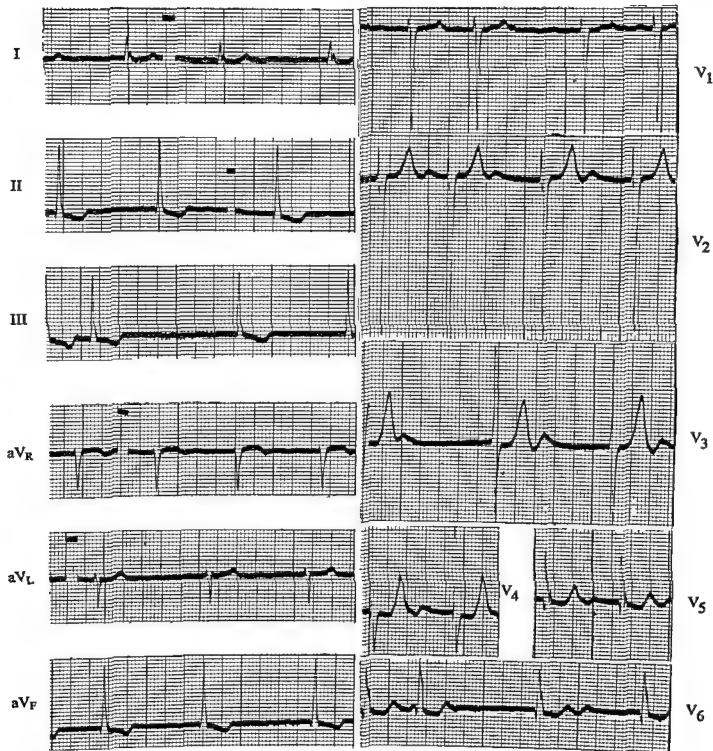
- A diastolic overload of the right ventricle
- B left ventricular hypertrophy
- C an incomplete left bundle branch block
- D anomalous atrioventricular conduction (Wolff Parkinson White)



The rhythm is

- A sinus bradycardia
- B sinus tachycardia
- C normal sinus rhythm
- D sino-atrial block

46 YEAR OLD FEMALE SHORTNESS OF BREATH ON EXERTION FIFTEEN YEARS
DIGITALIS LEAF 0.1 GM DAILY



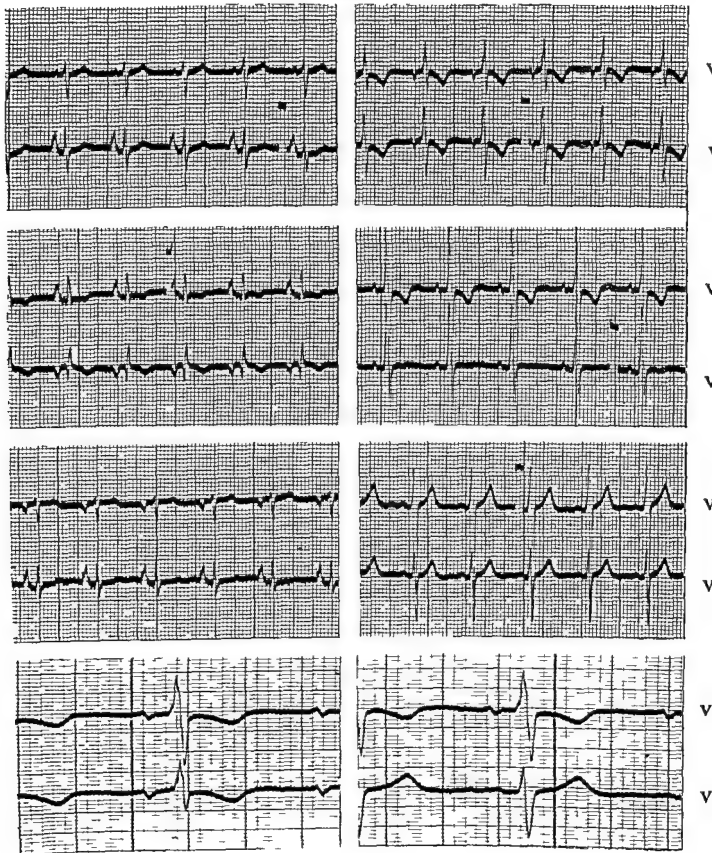
I The following is present

- A atrial fibrillation and left ventricular hypertrophy
- B atrial fibrillation and right ventricular hypertrophy
- C atrial flutter and left ventricular hypertrophy
- D atrial flutter and right ventricular hypertrophy

II The U waves are

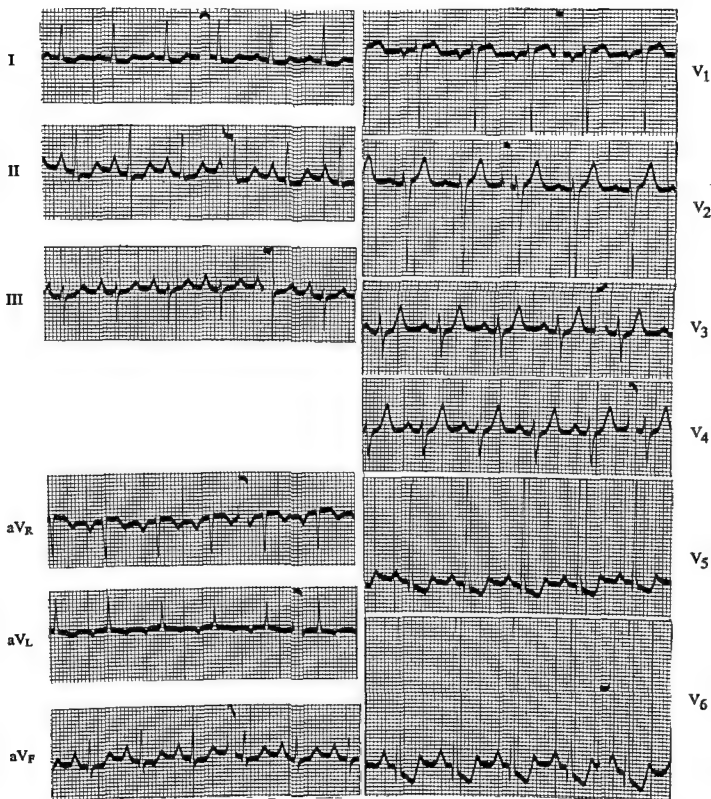
- A normal size
- B abnormally large
- C abnormally small
- D absent

62 YEAR OLD RETIRED MALE SEVERE DYSPNEA ON SLIGHT EXERTION FIFTEEN YEARS
NO ORTHOPNEA



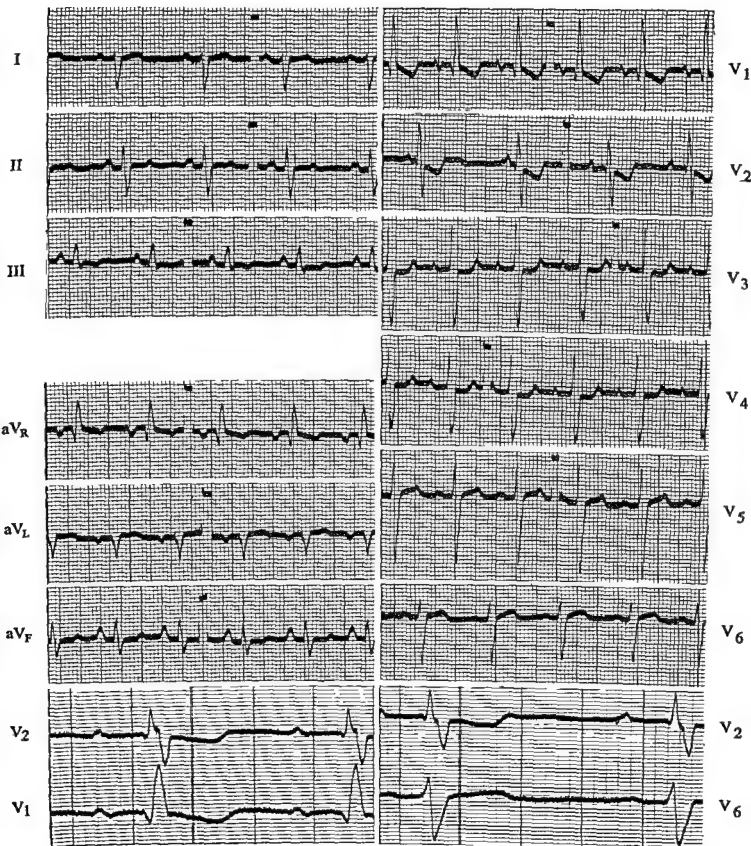
The tracing suggests

- A atrial enlargement only
- B ventricular hypertrophy only
- C atrial enlargement and right ventricular hypertrophy.
- D ventricular aneurysm



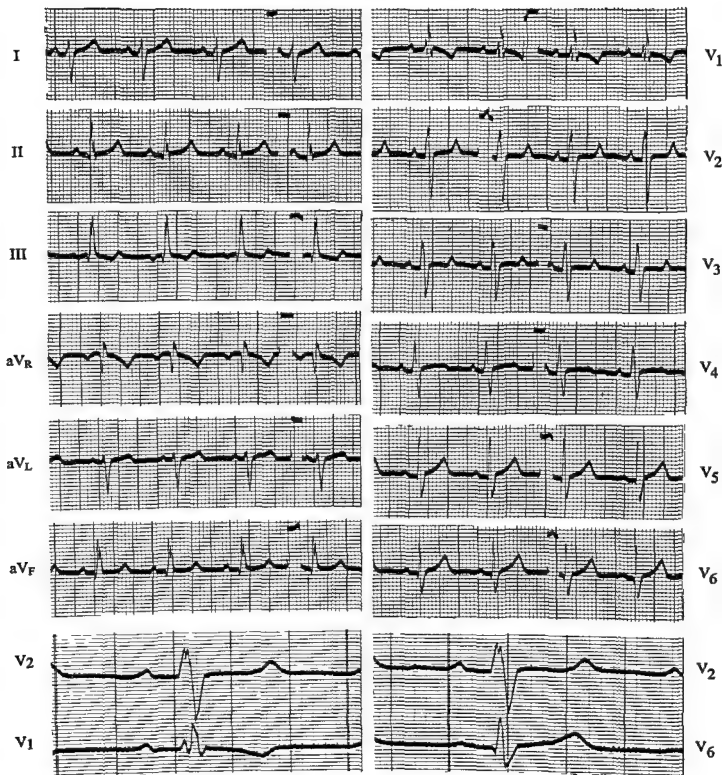
The electrocardiogram suggests the following

- A right ventricular hypertrophy only
- B atrial enlargement left ventricular hypertrophy and quinidine effect
- C atrial enlargement left ventricular hypertrophy and digitalis effect
- D digitalis effect and left ventricular hypertrophy without atrial enlargement



The electrocardiogram suggests

- A right ventricular hypertrophy
- B a right bundle branch block
- C pericarditis
- D pulmonary infarction

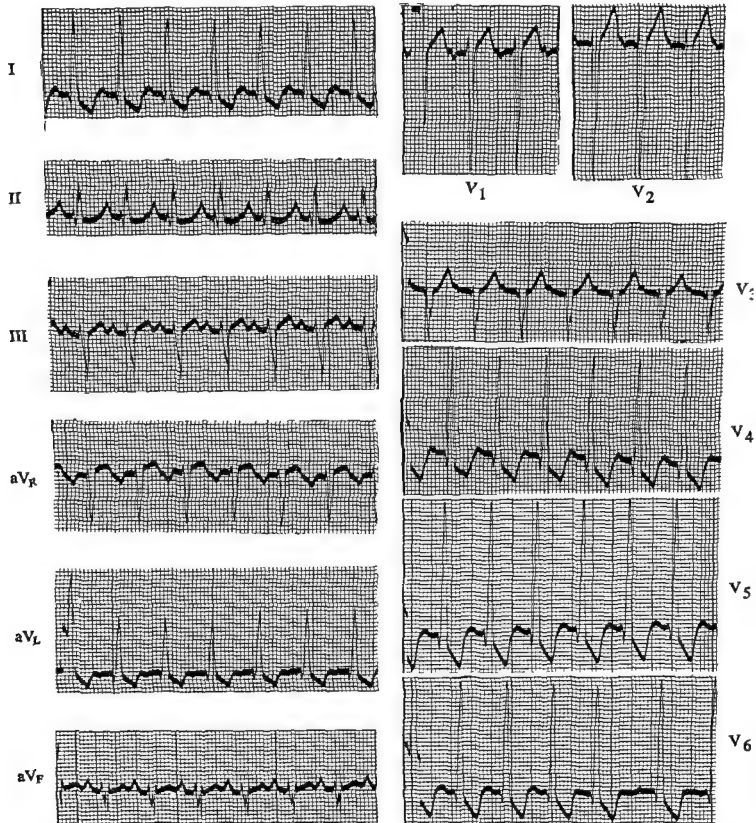


I The mean electric axis of the QRS complexes

- A is deviated to the right
- B is deviated to the left
- C shows no unusual deviation

II The following is present

- A a posterolateral myocardial infarct
- B an incomplete right bundle branch block
- C a complete right bundle branch block

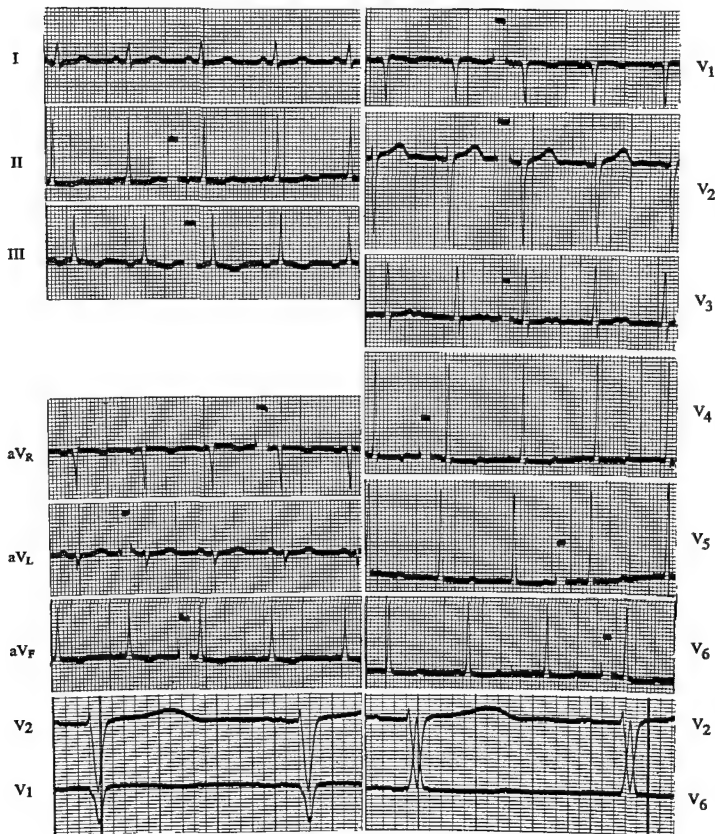


I The following is present

- A normal sinus rhythm
- B sinus arrhythmia
- C nodal rhythm
- D supraventricular tachycardia

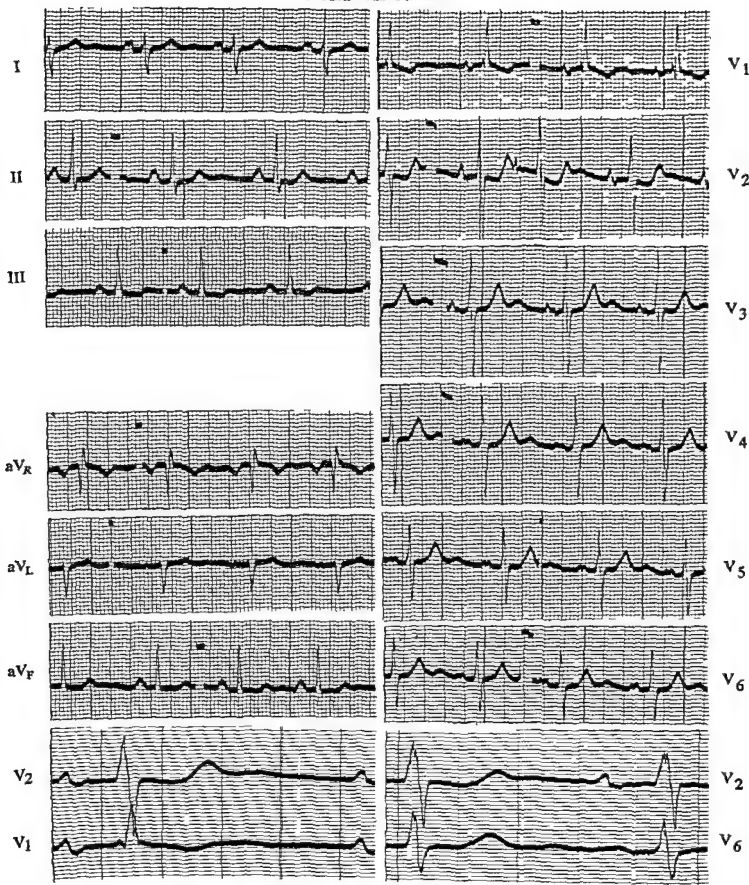
II The following is present

- A left ventricular hypertrophy
- B an old posterior infarct
- C right ventricular hypertrophy
- D a left complete bundle branch block



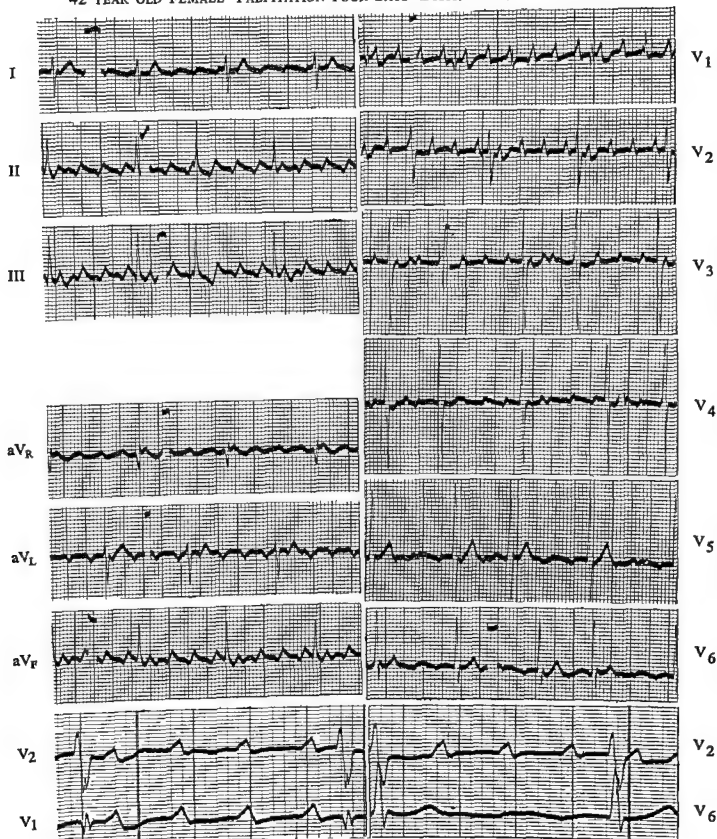
The electrocardiogram

- A is normal
- B indicates coronary artery disease
- C is consistent with an abnormal myocardium
- D is diagnostic of hypertensive heart disease



The tracing is suggestive but not diagnostic of

- A tricuspid stenosis
- B mitral stenosis
- C coarctation of the aorta
- D patent ductus arteriosus
- E right aortic arch

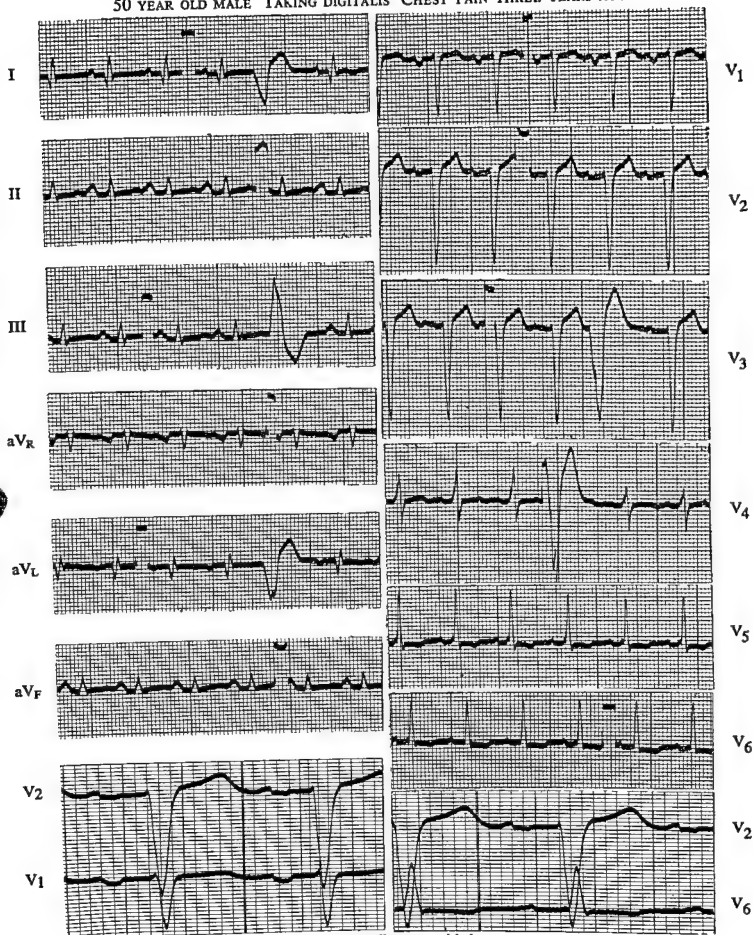


I The rhythm is

- A atrial flutter with block or atrial tachycardia with block
- B parasystole
- C incomplete interference dissociation

II There is

- A suggestive evidence of right ventricular hypertrophy
- B suggestive evidence of left ventricular hypertrophy



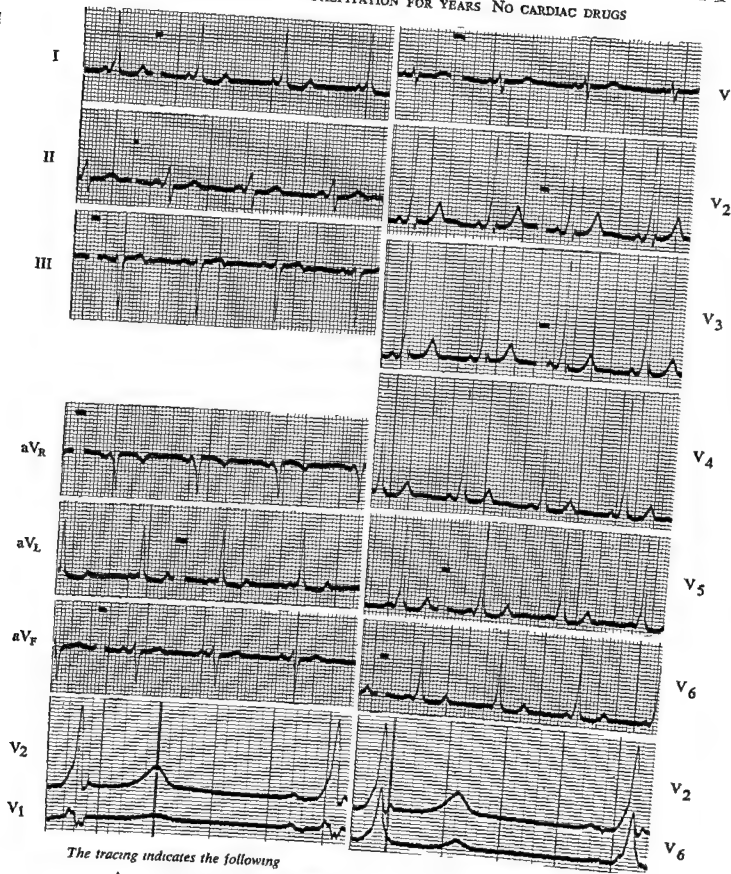
I The time of onset of the intrinsicoid deflection in lead V₆ is

- A delayed
- B normal
- C short

II The following is likely

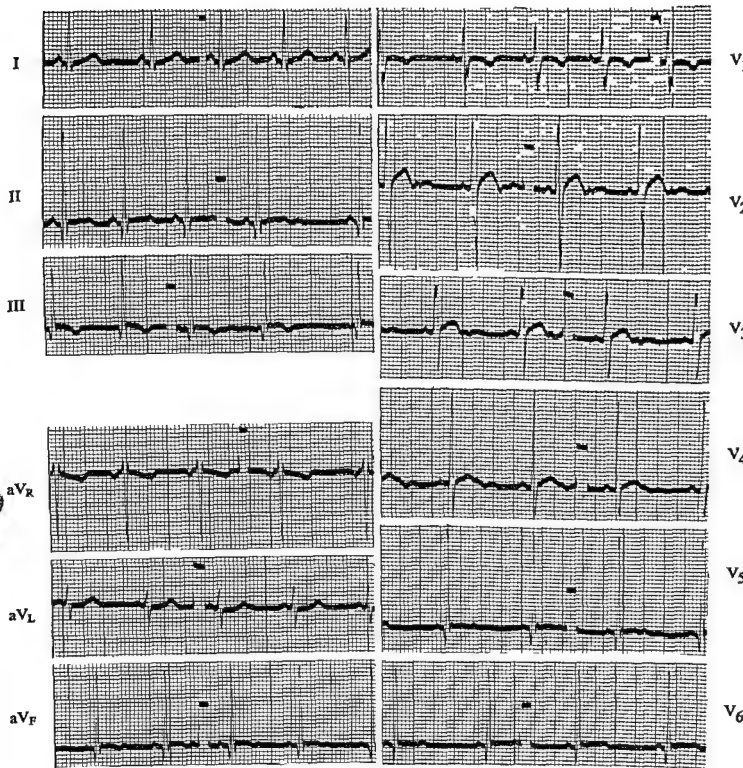
- A a myocardial infarct with ventricular ectopic beats
- B ventricular ectopic beats and anomalous atrioventricular conduction (Wolff Parkinson White)

50 YEAR OLD MALE PALPITATION FOR YEARS NO CARDIAC DRUGS



The tracing indicates the following

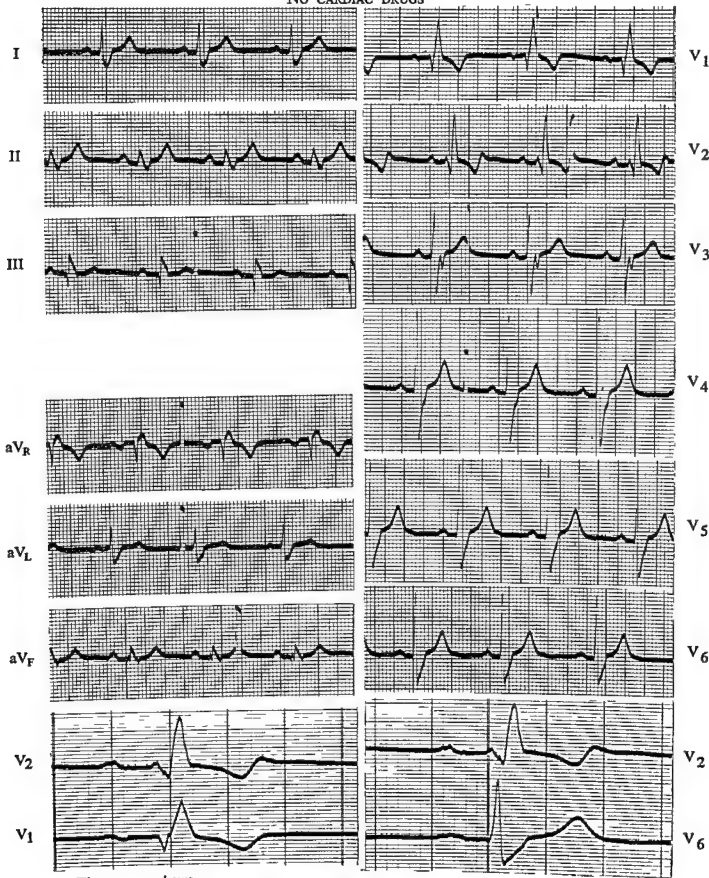
- A a true left bundle branch block
- B anomalous atrioventricular excitation (Wolff Parkinson White)
- C left ventricular hypertrophy
- D right ventricular hypertrophy



The electrocardiogram is

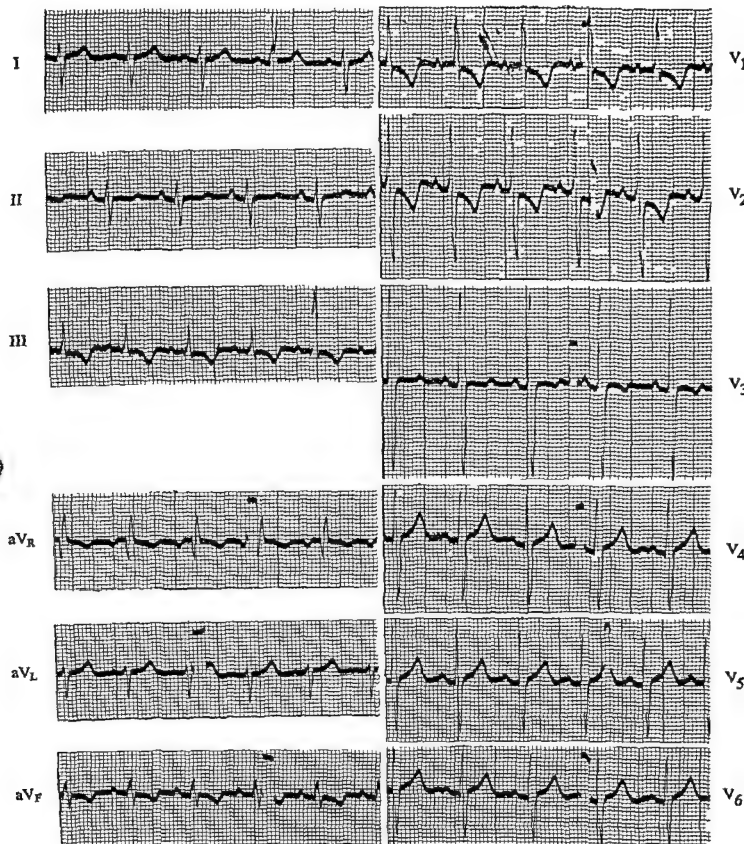
- A normal
- B in keeping with a diagnosis of left and right ventricular hypertrophy
- C excludes rheumatic heart disease
- D is diagnostic of pericarditis

NO CARDIAC DRUGS



The tracing shows

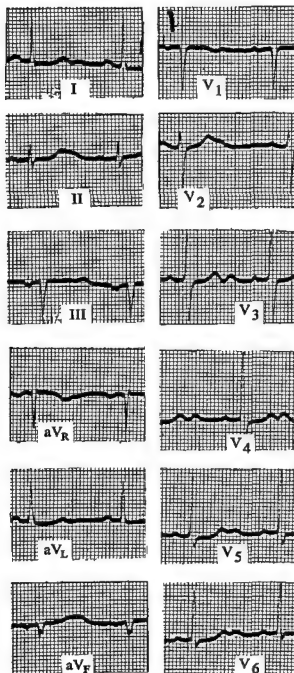
- A a right complete bundle branch block
- B a right incomplete bundle branch block
- C a right complete bundle branch block with an anterior myocardial infarct



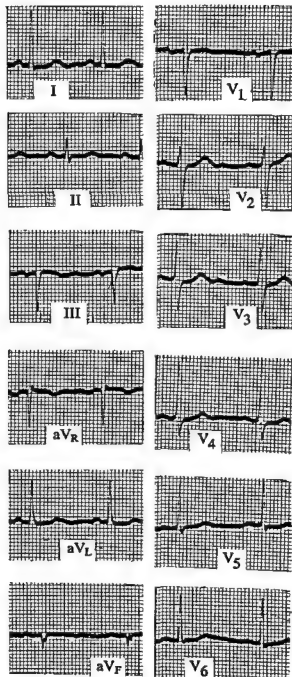
The tracing indicates the presence of

- A left ventricular hypertrophy without right ventricular hypertrophy
- B a complete right bundle branch block
- C hypertrophy of the right ventricle
- D an incomplete left bundle branch block

Before Treatment

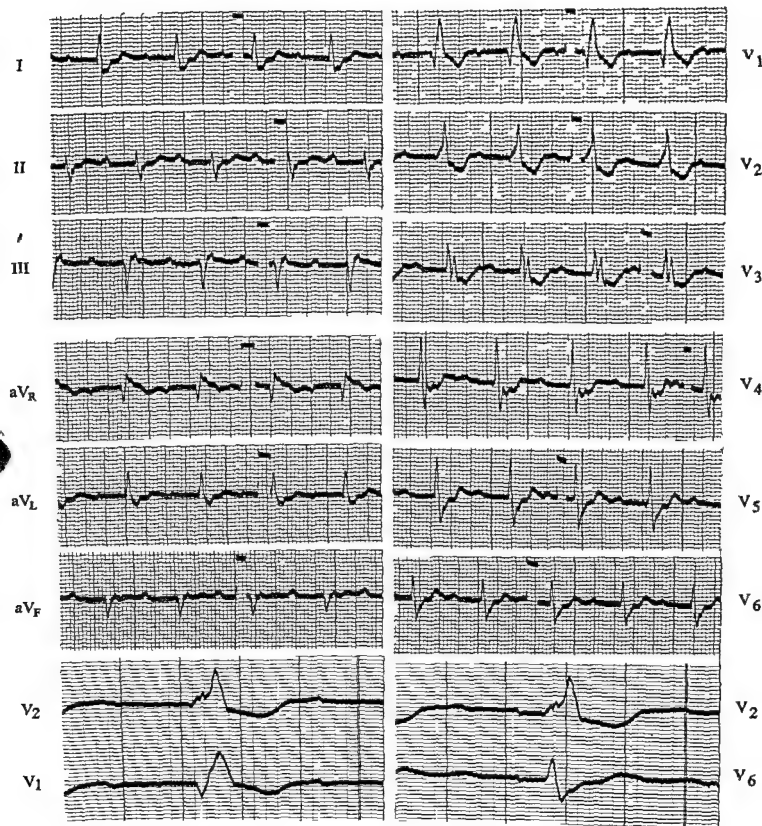


After Treatment



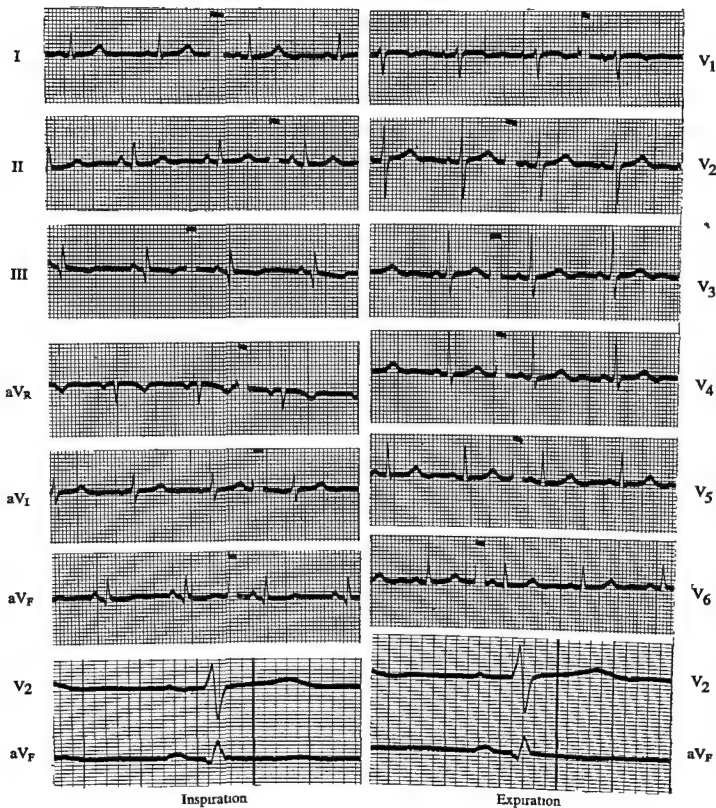
The tracing taken before treatment indicates

- A hyperkalemia
- B hypokalemia
- C hypercalcemia
- D hypernatremia



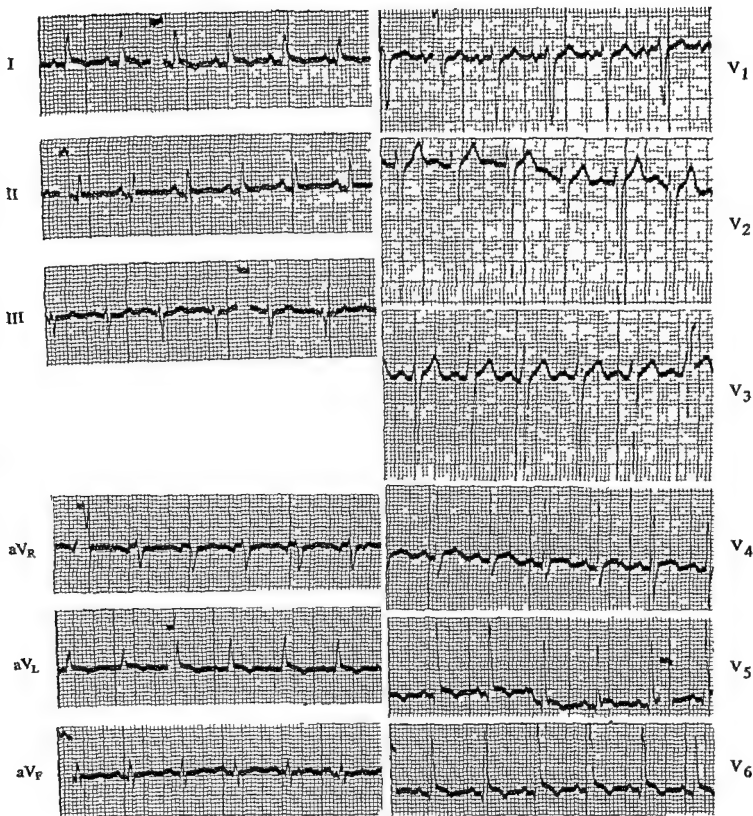
The conduction defects which are present (select more than one if necessary) are

- A an incomplete AV block without dropped beats (first degree)
- B a left complete bundle branch block
- C a right complete bundle branch block
- D an incomplete AV block with dropped beats (second degree)
- E a complete AV block



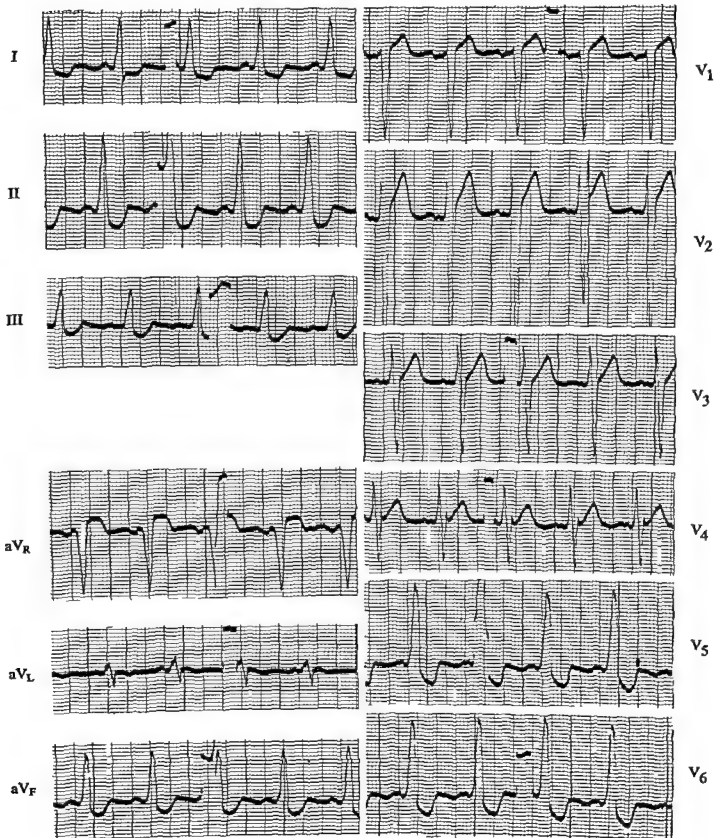
The tracing is

- A diagnostic of a posterior infarct
- B consistent with but not diagnostic of a posterior myocardial infarct
- C entirely normal
- D suggestive of an acute pulmonary infarct



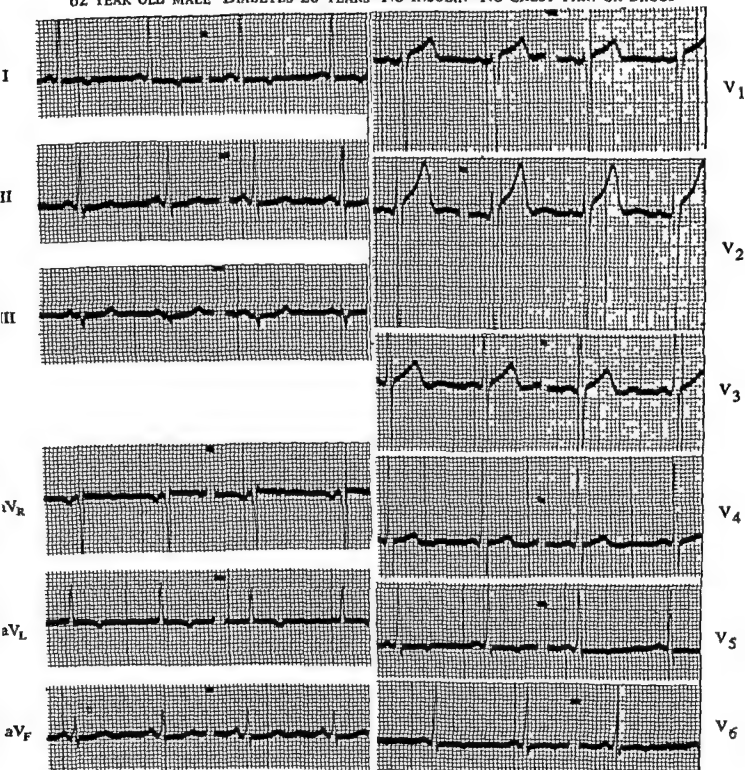
The tracing is indicative of

- A an acute lateral myocardial infarct
- B an acute injury to the subepicardial surface of the left ventricle
- C coronary insufficiency
- D coronary arteriosclerosis



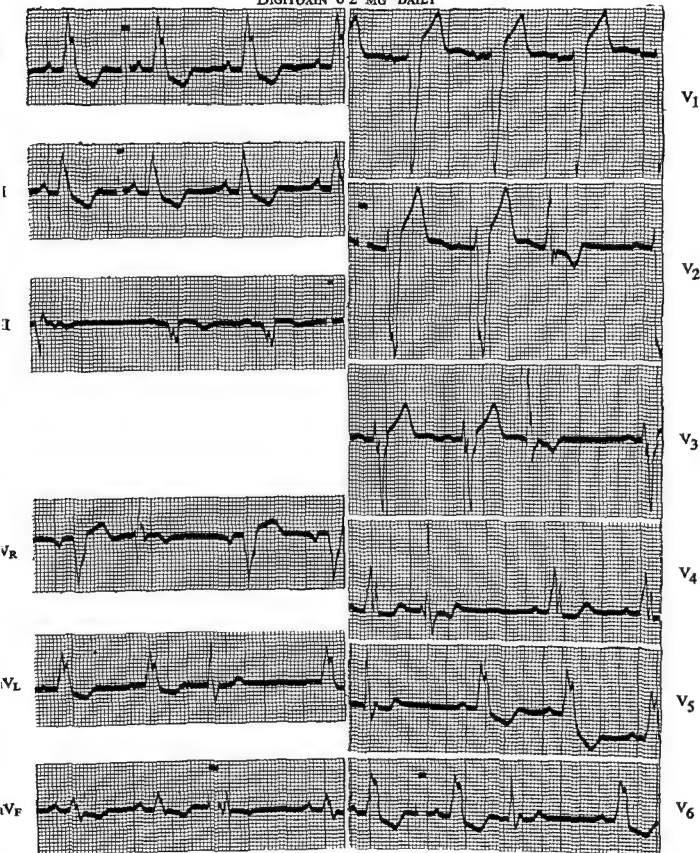
The following is present

- A a false bundle branch block (Wolff Parkinson White)
- B an incomplete left bundle branch block with digitalis effect
- C a posterior peri infarction block
- D a complete right bundle branch block



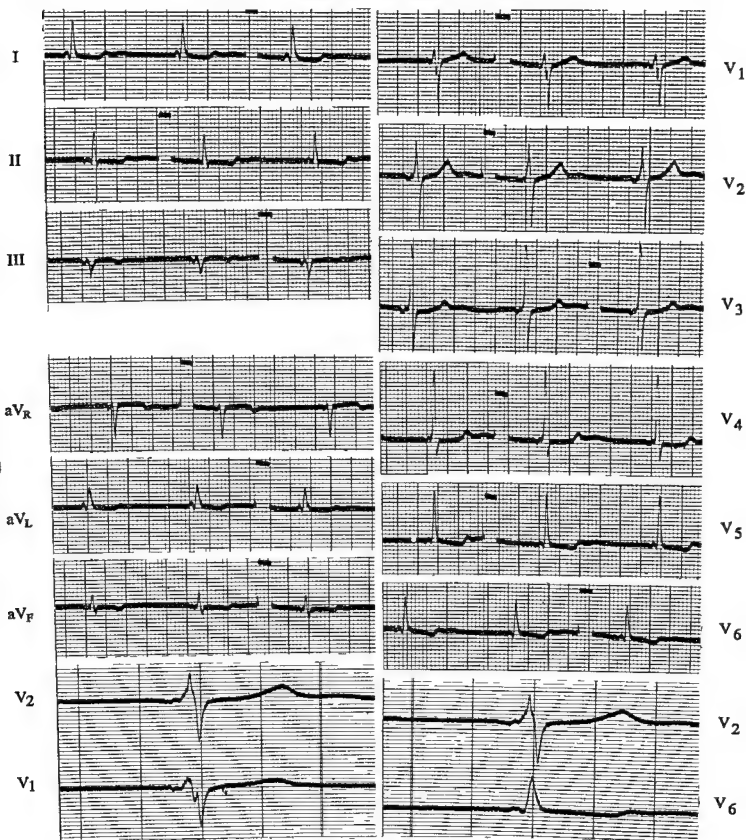
The electrocardiogram

- A is within normal limits
- B is diagnostic of an electrolyte disturbance
- C represents a transmural anterior myocardial infarct
- D is suggestive of left ventricular hypertrophy and/or myocardial ischemia



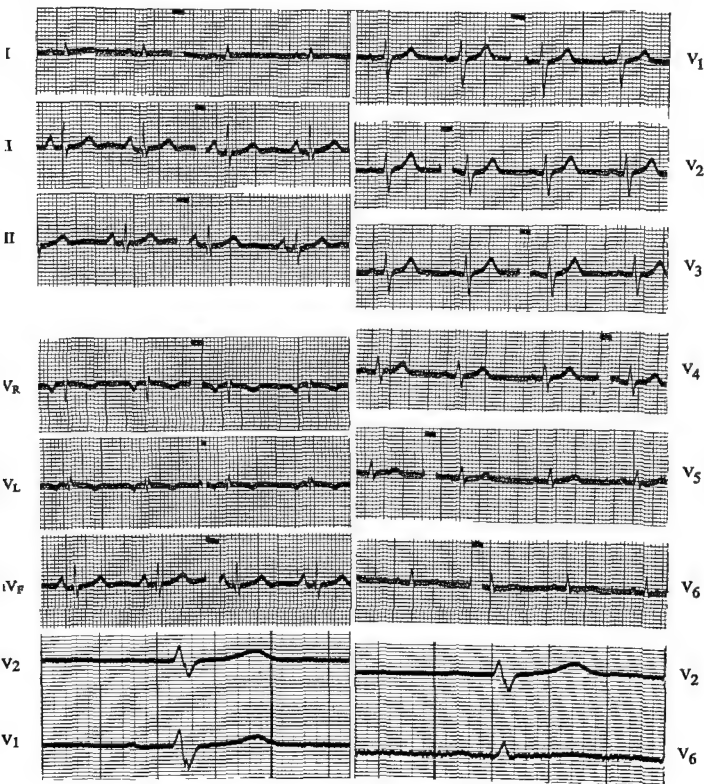
The electrocardiogram shows

- A a complete left bundle branch block
- B a complete left bundle branch block with ventricular ectopic beats
- C an incomplete left bundle branch block
- D an incomplete left bundle branch block with ventricular ectopic beats



The rhythm is

- A normal sinus rhythm
- B sinus bradycardia
- C nodal rhythm with retrograde conduction
- D nodal rhythm without retrograde conduction
- E nodal rhythm with retrograde conduction with abnormalities of the ST segments



The electrocardiogram is

- A indicative of a myocardial infarct involving the lateral wall of the left ventricle
- B consistent with but not diagnostic of a left pneumothorax
- C indicative of rheumatic mitral stenosis

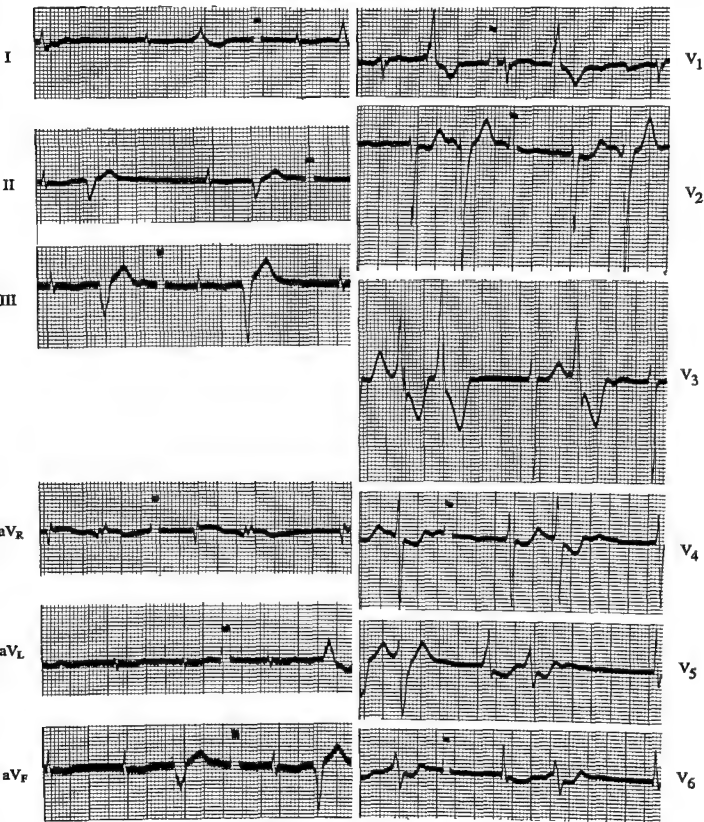


I The cardiac rhythm is

- A sino atrial block
- B sinus bradycardia
- C sinus arrest
- D intraventricular block

II The following is present

- A a nodal escape beat without retrograde conduction
- B a ventricular escape beat
- C a nodal escape beat with retrograde conduction



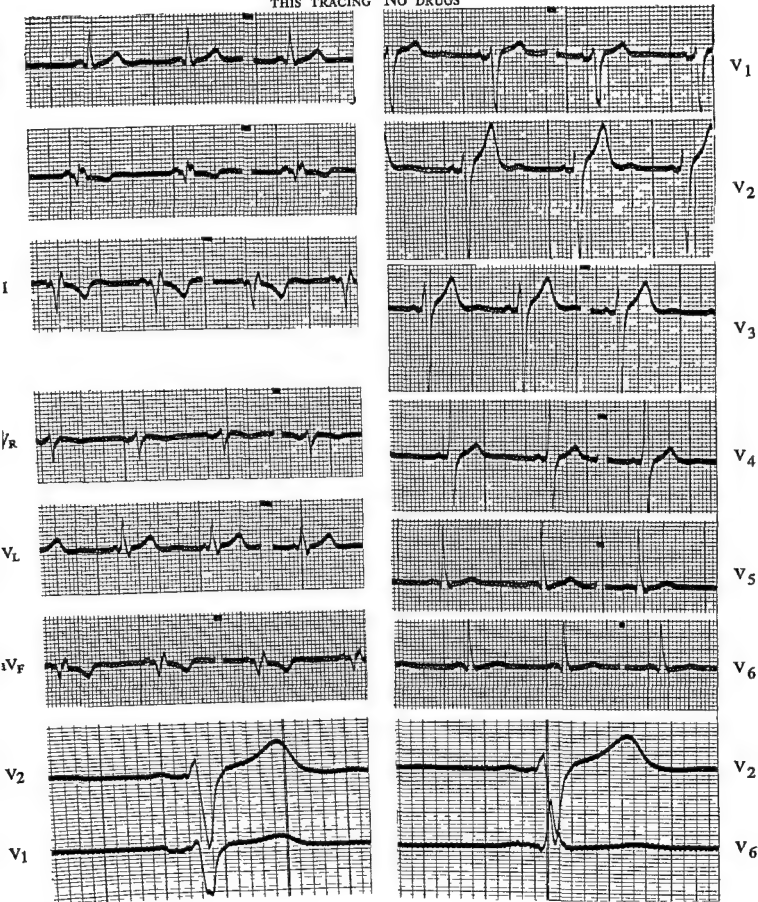
I The following artifact is present

- A muscle tremor
- B interfering alternating current and incorrect standardization
- C loose filaments in vacuum tube

II The rhythm is

- A atrial fibrillation
- B atrial fibrillation and multifocal - ventricular ectopic beats
- C atrial fibrillation and ventricular and atrial premature contractions

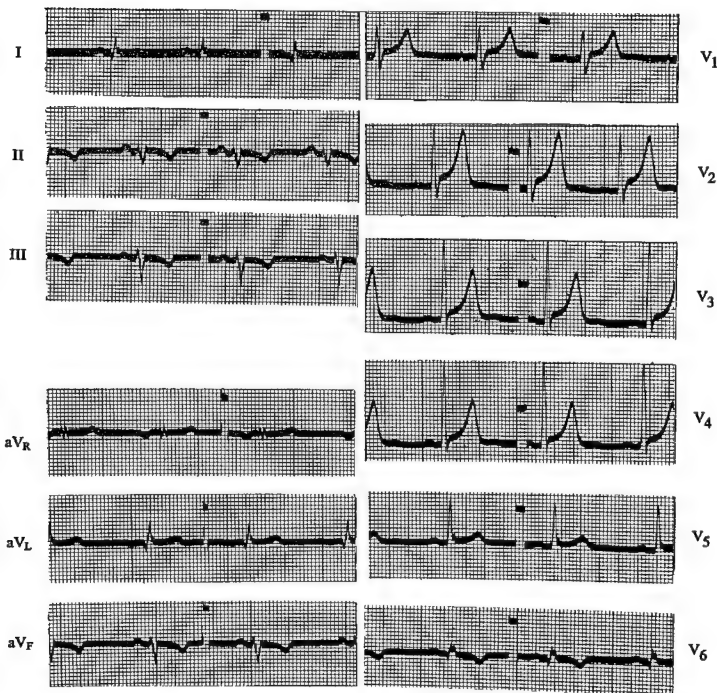
54 YEAR OLD MALE MECHANIC CHEST PAIN LASTING ONE HOUR EIGHT MONTHS PRIOR TO
THIS TRACING NO DRUGS



The tracing indicates the presence of

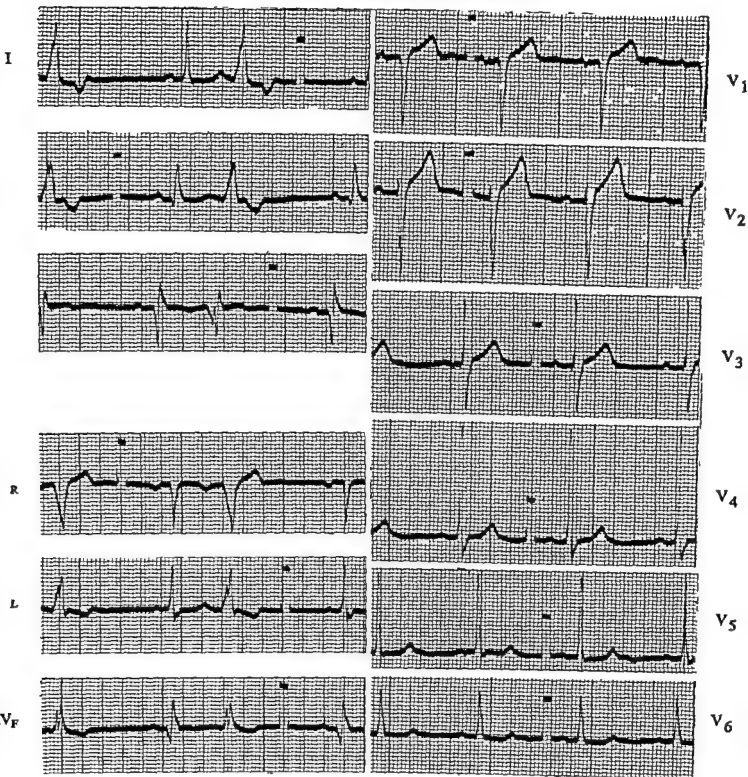
- A an old posterior myocardial infarct with per infarction block
- B a left typical complete bundle branch block
- C a false bundle branch block (Wolff Parkinson White)
- D a recent posterior myocardial infarct

55 YEAR OLD MALE SUBSTERNAL PAIN RADIATING TO BACK TEN MONTHS AGO
HANDS STIFF FOR EIGHT MONTHS



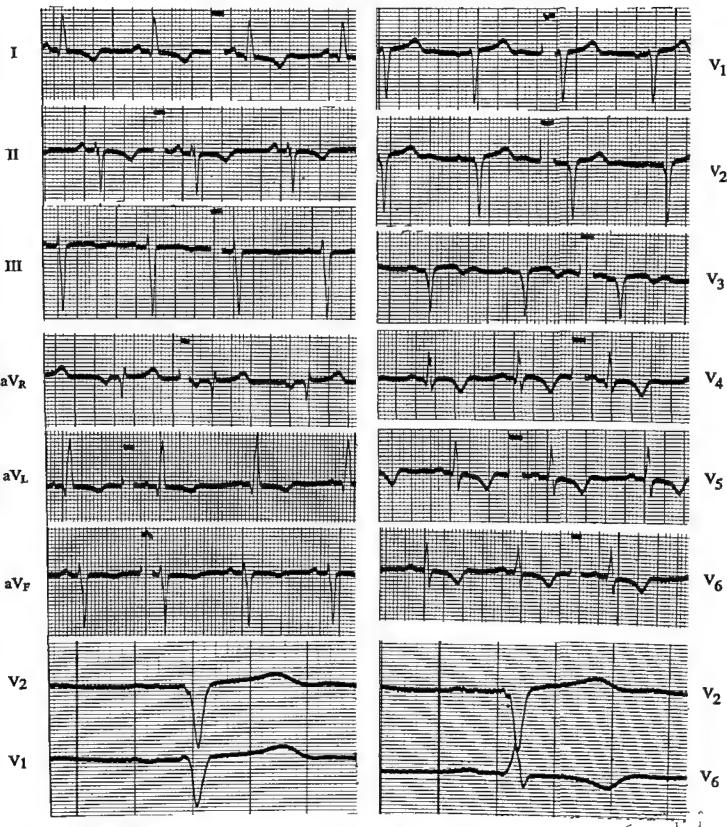
The tracing is suggestive of

- A anterior myocardial ischemia
- B anterior myocardial infarct
- C posterior myocardial ischemia with a posterolateral myocardial infarct
- D no heart disease



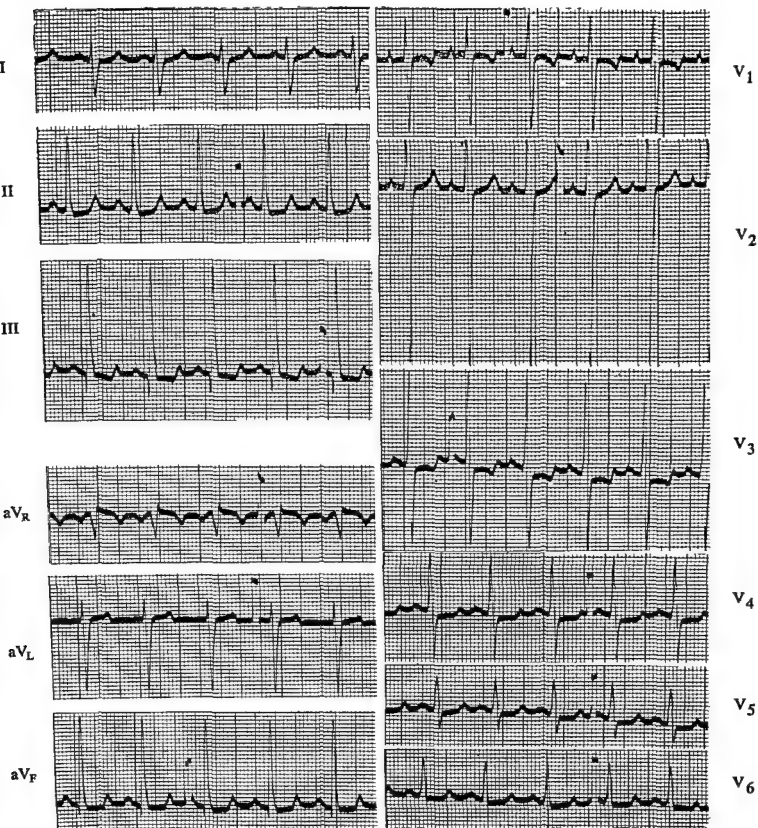
The following is present

- A a posterior infarct without other abnormalities
- B a posterior infarct and ventricular ectopic beats without other abnormalities
- C a posterior infarct with ventricular ectopic beats and local intraventricular block
- D anomalous atrioventricular conduction (Wolff Parkinson White)



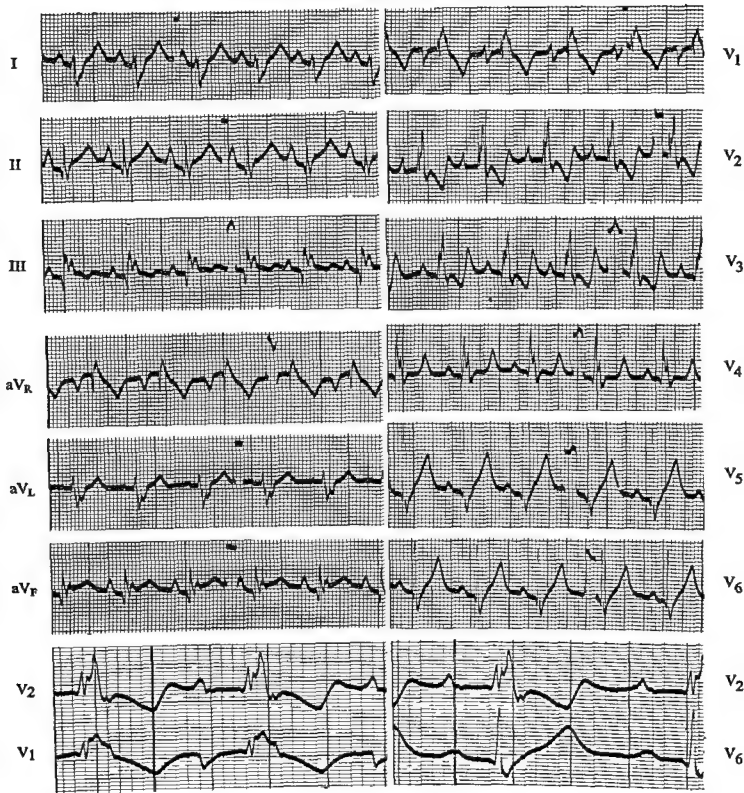
The tracing suggests

- A ischemia involving the anteroapical lateral and posterolateral aspect of the left ventricle
- B necrosis of a large part of the anteroapical lateral and posterolateral aspects of the left ventricle
- C necrosis or myocardial death of the anteroapical portion of the left ventricle with anteroapical lateral and posterolateral myocardial ischemia



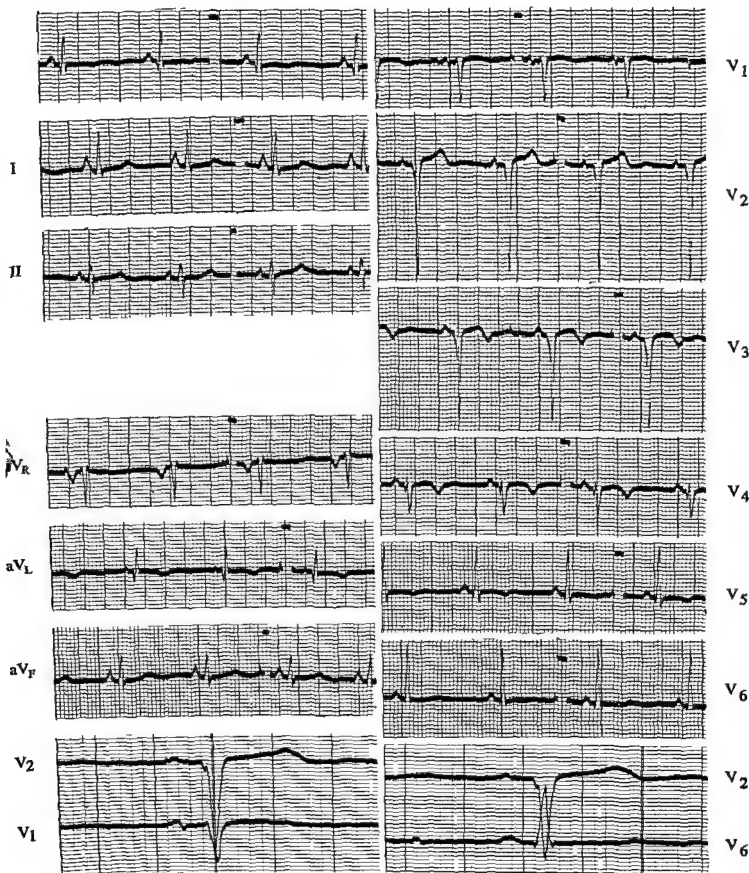
The tracing suggests

- A right ventricular hypertrophy without left ventricular hypertrophy
- B left ventricular hypertrophy without right ventricular hypertrophy
- C right and left ventricular hypertrophy



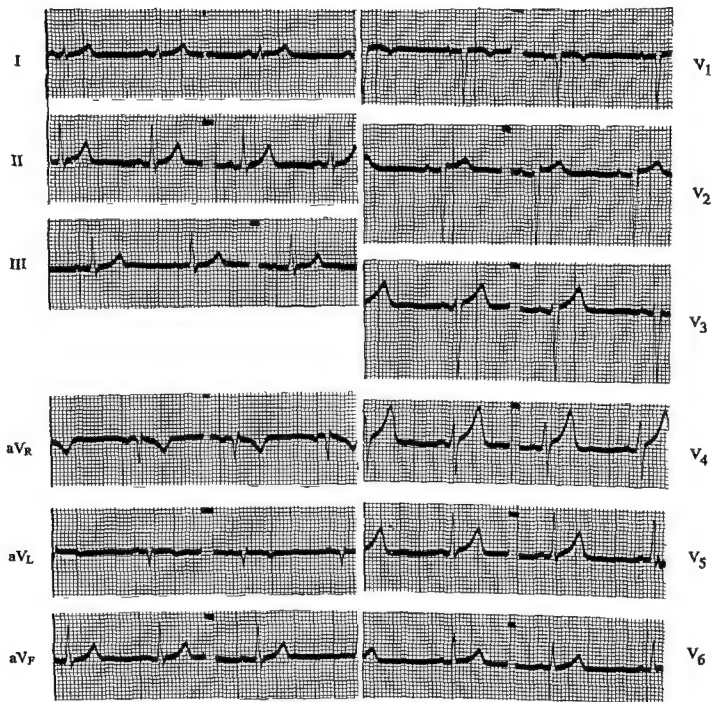
The electrocardiogram is in keeping with the following disease state

- A uncomplicated ventricular septal defect
- B Ebstein's syndrome
- C tricuspid stenosis
- D aortic valve disease



The tracing is typical of

- A an acute (few hours) anterolateral myocardial infarct
- B a subacute or chronic (weeks or months) anterolateral myocardial infarct
- C anteroapical myocardial ischemia without infarction
- D an incomplete left bundle branch block

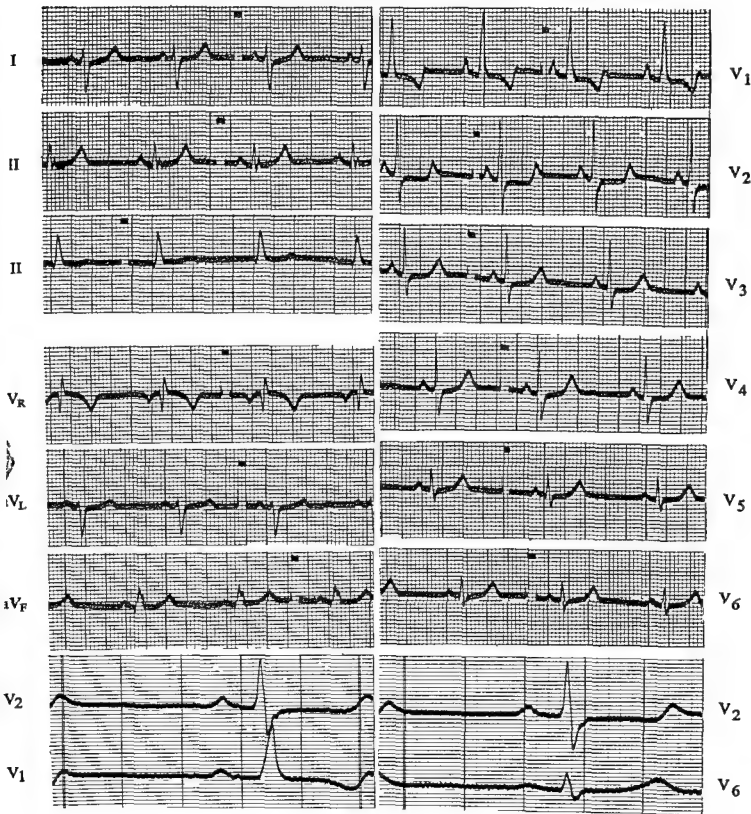


I The inverted T waves in lead aV_L are

- A indicative of ischemia of the lateral wall of the left ventricle
- B indicative of a lateral myocardial infarct
- C within normal limits

II The electrocardiographic position is

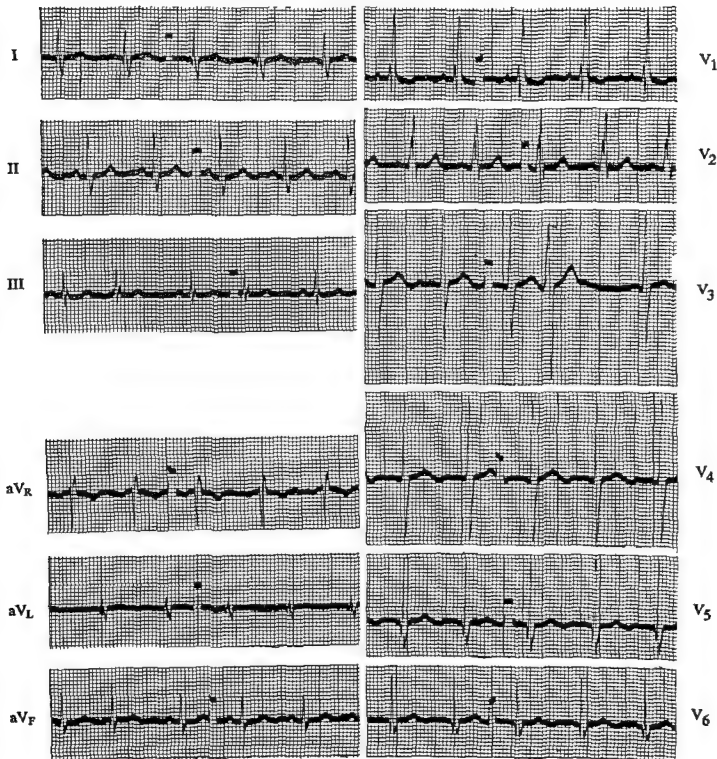
- A horizontal
- B semihorizontal
- C intermediate
- D indeterminate
- E vertical



The tracing is most consistent with the following condition

- A dextrocardia not associated with other cardiac abnormalities
- B severe pulmonary valvular stenosis
- C acute cor pulmonale
- D aortic valve disease

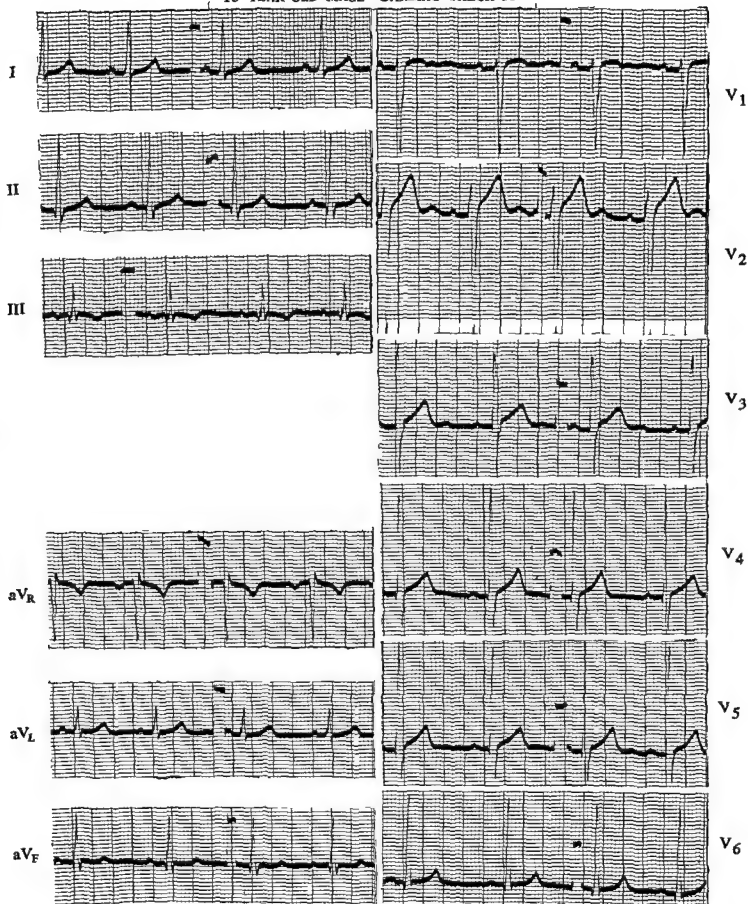
15 YEAR OLD FEMALE HEIGHT 68 INCHES WEIGHT 75 POUNDS CARDIAC CHECK UP



The following is present

- A an incomplete right bundle branch block without other abnormalities
- B an incomplete right bundle branch block and right ventricular hypertrophy without other abnormalities
- C an incomplete right bundle branch block right ventricular hypertrophy and a ventricular ectopic beat

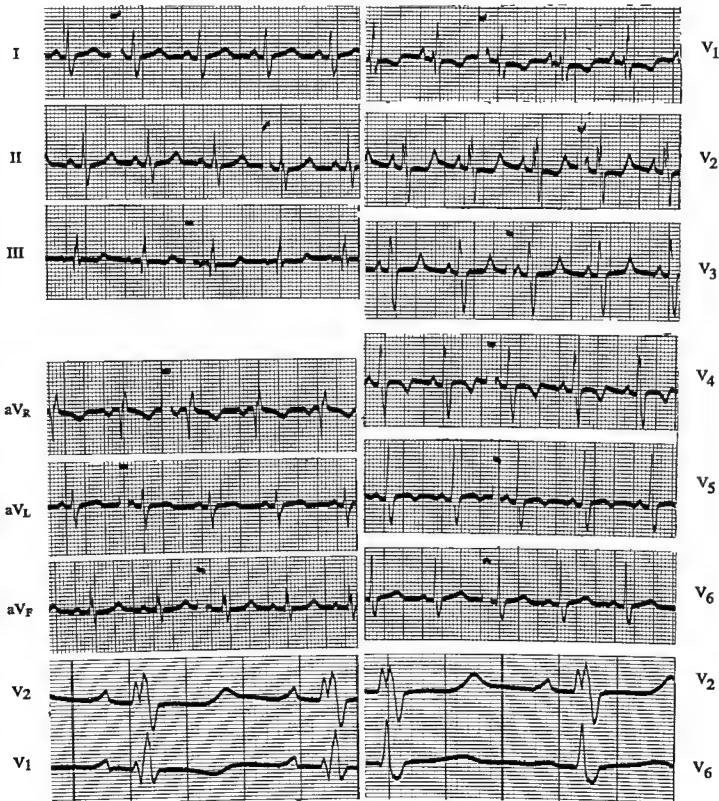
15 YEAR OLD MALE CARDIAC CHECK UP



The tracing is consistent with but not diagnostic of

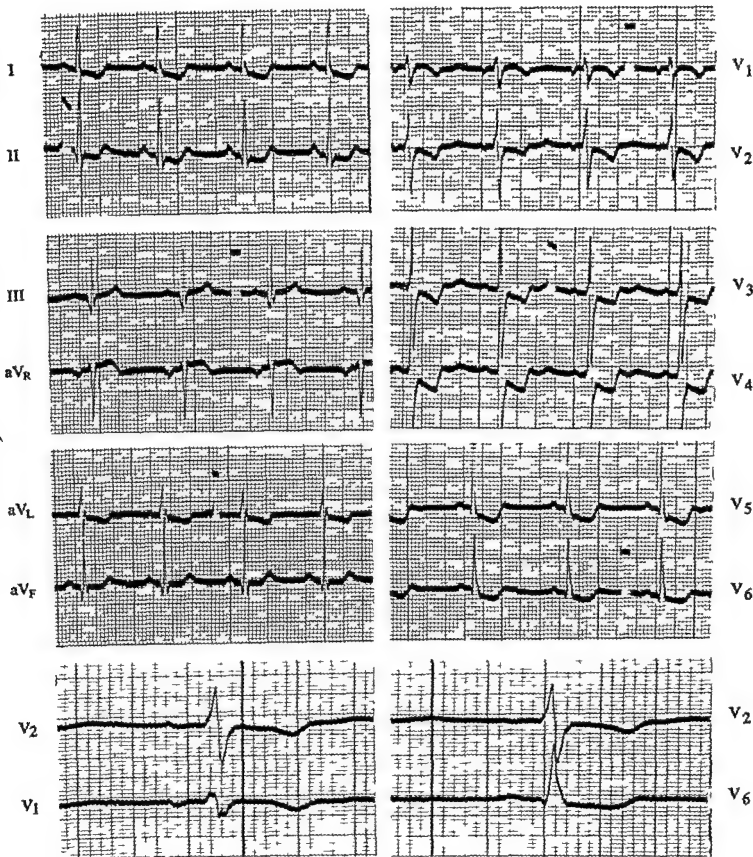
- A left ventricular hypertrophy
- B right ventricular hypertrophy
- C left and right ventricular hypertrophy
- D a left incomplete bundle branch block

13 YEAR OLD GIRL SHORTNESS OF BREATH SINCE BIRTH HEIGHT 52 INCHES WEIGHT 85 POUNDS



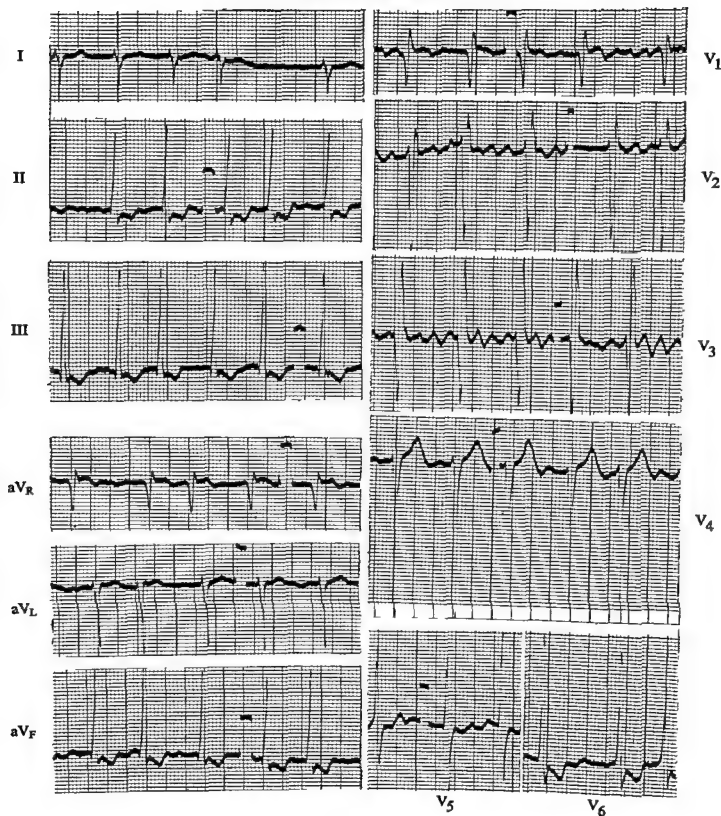
The tracing suggests

- A a false bundle branch block (Wolff Parkinson White)
- B an incomplete right bundle branch block
- C a left bundle branch block
- D a partial atrioventricular block



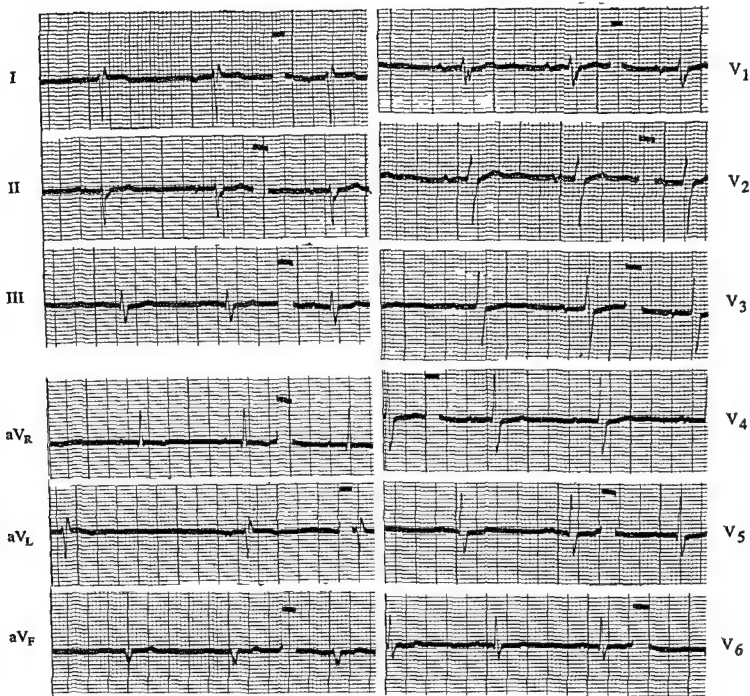
The ST segments are characteristic of

- A hyperkalemia
- B hypocalcemia
- C digitalis in subtherapeutic doses without myocardial injury and ischemia
- D procaine amide
- E therapeutic or excessive doses of digitalis and myocardial injury and ischemia



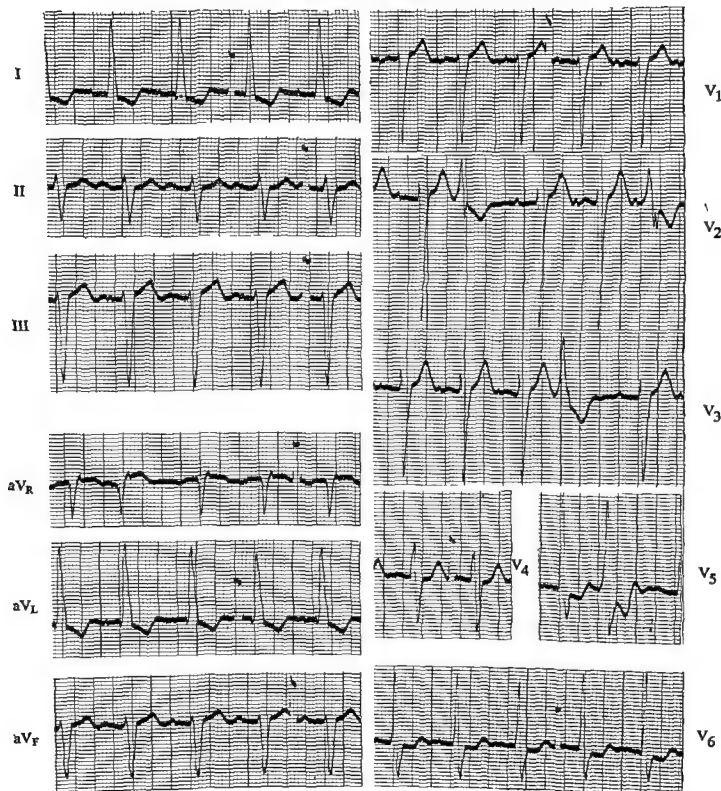
The electrocardiogram is consistent with the following clinical states

- A mitral stenosis and insufficiency
- B subaortic stenosis
- C patent ductus arteriosus without other abnormalities



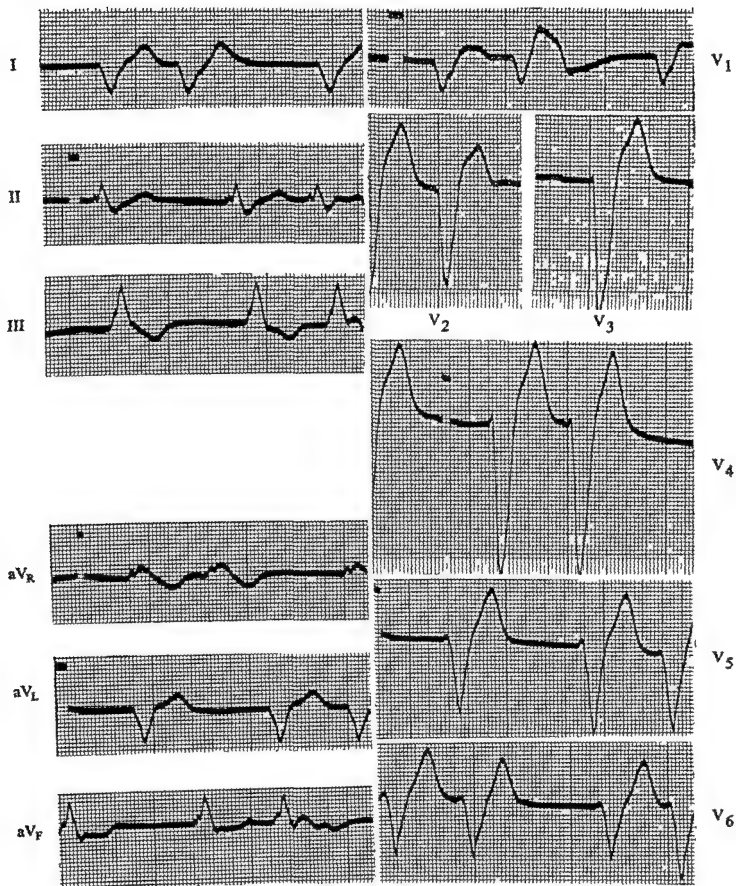
The following is present

- A dextrocardia ¹
- B right ventricular hypertrophy
- C switching of the lead I wires when applied to the patient's arms
- D a right complete bundle branch block



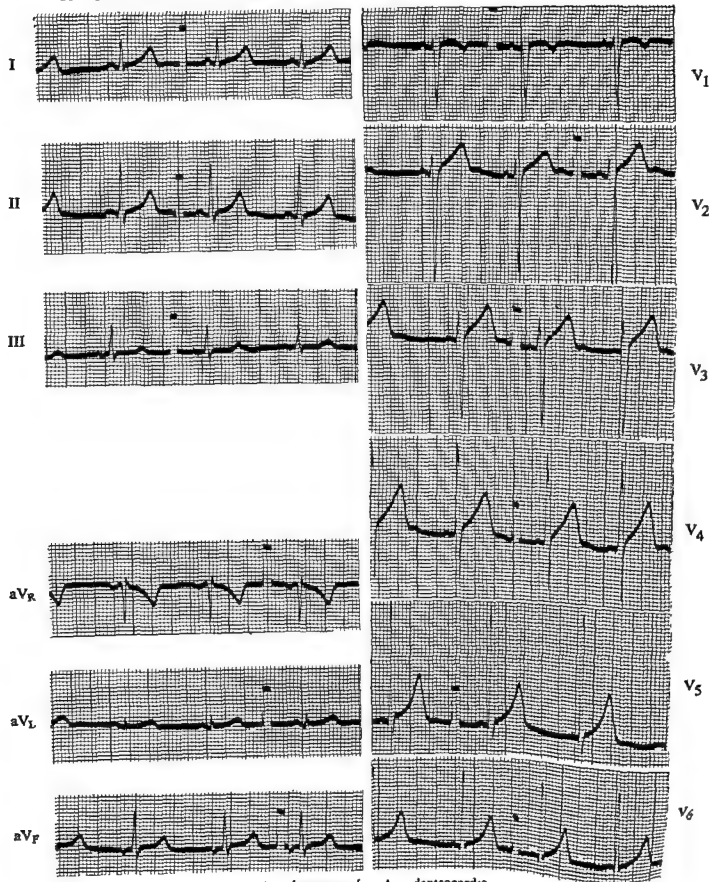
The tracing suggests the following (select more than one if desired)

- A a complete left bundle branch block
- B an incomplete left bundle branch block
- C a partial AV block without dropped beats
- D nodal premature contractions
- E ventricular premature contractions



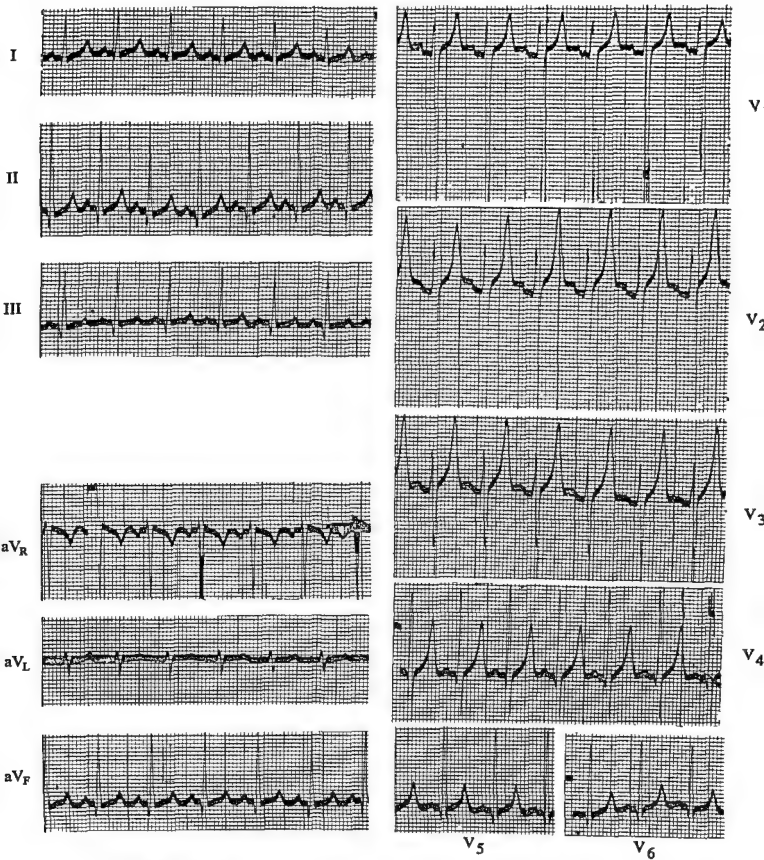
The tracing is suggestive of

- A a left typical complete uncomplicated bundle branch block
- B a right complete uncomplicated bundle branch block
- C an intraventricular block associated possibly with a dying heart or with hyperkalemia
- D severe hypokalemia ✓



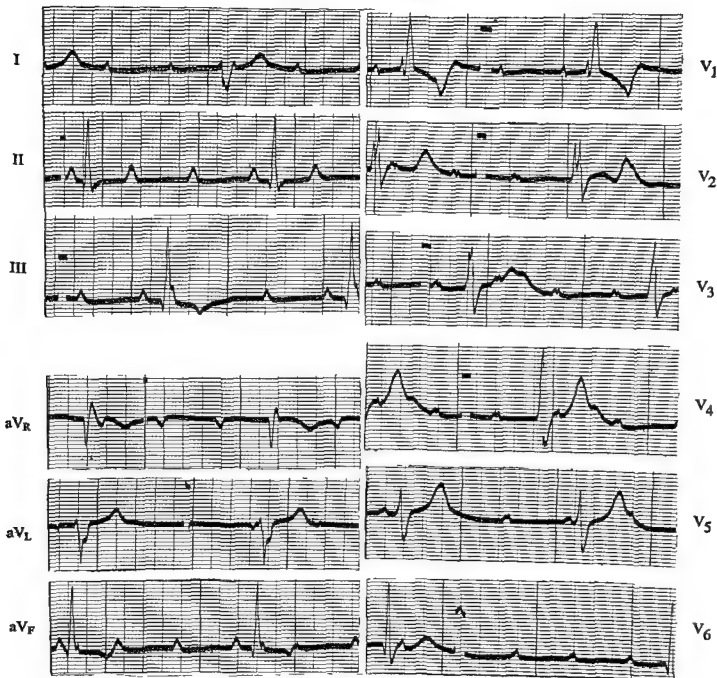
The tracing is in keeping with a diagnosis of

- A dextrocardia
- B Ebstein's syndrome
- C uncomplicated tetralogy of Fallot
- D small ventricular septal defect
- E large atrial septal defect



The tracing suggests

- A anterior subepicardial ischemia
- B hypokalemia
- C hyperkalemia
- D hypocalcemia
- E hypercalcemia



The following is present

- A sino atrial block
- B interference dissociation
- C complete AV block with idioventricular rhythm✓
- D a right incomplete bundle branch block
- E a right complete bundle branch block
- F a complete AV block with nodal rhythm

PART B

**QUESTIONS ON
ELECTROCARDIOGRAPHIC INTERPRETATION**

ARRHYTHMIAS

- 1 *Atrial fibrillation is characterized by*
 - A the absence of clearly distinguishable P waves and irregular R R intervals
 - B R R intervals which show phasic variations with respiration
 - C clearly defined P waves of similar configuration with variable P R intervals
- 2 *Atrial fibrillation usually has an atrial rate*
 - A which exceeds 300 beats per minute
 - B is less than 200 beats per minute
 - C is less than 100 beats per minute
- 3 *Atrial fibrillation or flutter usually but not invariably is associated with demonstrable disease in the heart or somewhere in the body*
 - A True
 - B False
- 4 *Atrial fibrillation is*
 - A usually accompanied by an irregular ventricular rhythm
 - B seldom accompanied by an irregular rhythm
- 5 *Atrial flutter when untreated commonly has a rate of*
 - A 450 beats per minute
 - B 300 beats per minute ✓
 - C 150 beats per minute
 - D 100 beats per minute
- 6 *Atrial tachycardia is characterized by*
 - A a rapid atrial rate often with nearly regular P P intervals
 - B absolute irregularity of atrial contraction
 - C a gradual slowing of atrial contractions following breath holding or deep breathing
- 7 *When atrial tachycardia changes to sinus rhythm the conversion usually takes place*
 - A gradually
 - B abruptly
- 8 *Paroxysmal atrial tachycardia with block frequently results from*
 - A epinephrine injection
 - B extreme physical exertion
 - C digitalis intoxication
 - D hyperthyroidism
- 9 *Paroxysmal atrial tachycardia is*
 - A pathognomonic of organic cardiac disease
 - B good evidence of organic cardiac disease
 - C not in itself indicative of organic cardiac disease
- 10 *Paroxysmal tachycardia may be atrial nodal or ventricular*
 - A True
 - B False
- ✓ 11 *Electric alternation always accompanies pulsus alternans,*
 - A True
 - B False

- 12 *A nodal escape*
- A occurs commonly with sinus arrest when the atrioventricular node assumes control for one or more beats
 - B describes slow rhythms of ventricular origin when retrograde conduction into the atria occurs
 - C describes a nodal rhythm where QRS precedes an inverted P wave
- 13 *AV nodal rhythm with retrograde conduction is characterized typically by*
- A positive P waves in lead II
 - B inverted P waves in lead aV_F
 - C positive P waves in leads I and aV_F
- 14 *Nodal rhythm is caused by a periodic discharge from the*
- A sinus node
 - B atrioventricular node
- 15 *With nodal rhythm with retrograde conduction the P waves*
- A always precede the QRS complexes
 - B always follow the QRS complexes
 - C always fall within the QRS complexes
 - D may precede, fall within or follow the QRS complexes
- 16 *Nodal tachycardia with retrograde conduction is characterized by*
- A rapid regular atrial contractions occurring at a rate greater than 100 beats per minute with inverted P waves in leads II, III and aV_F
 - B an atrial rate between 60 and 100 beats per minute with inverted P waves in leads II, III and aV_F
 - C an atrial rate over 100 beats per minute with positive P waves in lead aV_F
- 17 *Nodal rhythm is*
- A always accompanied by retrograde conduction through the atria
 - B not always accompanied by retrograde conduction through the atria
- 18 *With parasystole the interval in seconds between any two complexes produced by the ectopic pacemaker will be divisible by a common denominator and results in a whole number as a quotient*
- A True
 - B False
- 19 *Sinus arrest usually is*
- A a functional arrhythmia characterized by temporary cessation of activity of the sinus node
 - B produced by organic disease of the sino atrial node and is associated with long periods of atrial standstill
- 20 *Phasic sinus arrhythmia is present when the cardiac rate varies with*
- A respiration and the pacemaker is in the sinus node
 - B exercise when the pacemaker is outside the sinus node
- 21 *Phasic sinus arrhythmia is in itself*
- A diagnostic of cardiac disease
 - B not diagnostic of cardiac disease
- 22 *Sinus bradycardia is diagnosed when the cardiac rate is*
- A less than 60 beats per minute and the pacemaker is in the sinus node
 - B between 60 and 100 beats per minute and the pacemaker is in the sinus node
 - C less than 60 beats per minute with the pacemaker in the atrioventricular node

- 23 *The cardiac rate normally varies*
 A inversely with age from birth to adulthood (the older the age the slower the rate)
 B directly with age from birth to adulthood
- 24 *Normal sinus rhythm is diagnosed when the pacemaker is*
 A in the sinus node and the cardiac rate is from 60 to 100 beats per minute
 B in the atrioventricular node and the cardiac rate is from 60 to 100 beats per minute
 C in the sinus node and the cardiac rate exceeds 100 beats per minute
- 25 *Sinus tachycardia as a general rule*
 A does not exceed 160 beats per minute^d
 B often exceeds 180 beats per minute
 C falls between 60 and 100 beats per minute
- 26 *Sinus tachycardia is*
 A diagnostic of hyperthyroidism
 B suggestive of hypothyroidism
 C consistent with a normal heart as well as with cardiac and other disease states
- 27 *Supraventricular tachycardia includes*
 A sinus atrial or nodal tachycardia and atrial fibrillation or flutter
 B atrial fibrillation or atrial flutter only
 C sinus atrial or nodal tachycardia only
- 28 *Ventricular fibrillation is characterized by*
 A irregular R R intervals and wide QRS complexes which are irregular in amplitude and duration and which are not regularly preceded by P waves
 B regular wide QRS complexes preceded by P waves
 C QRS complexes of normal width and configuration
- ✓ 29 *Multiple ventricular ectopic beats are diagnosed when two or more ventricular ectopic beats of similar size configuration and polarity are present*
 A True
 B False
- 30 *Multifocal ventricular ectopic beats are diagnosed when in a lead two or more ventricular ectopic beats*
 A differ from each other in size configuration or polarity
 B are similar in size configuration and polarity
- 31 *Ventricular premature contractions characteristically are*
 A preceded by P waves
 B not preceded by P waves
- 32 *Ventricular premature contractions recorded with the subject at rest are*
 A diagnostic of organic myocardial disease.
 B not in themselves diagnostic of organic myocardial disease
- 33 *Ventricular ectopic beats arising from the base of the heart are in the three standard leads predominately*
 A negative
 B positive
 C biphasic

- ✓ 34 *Bigeminy is characterized by groups of two beats consisting of*
- A a normal beat and a ventricular ectopic beat
 - B a normal beat and an atrial premature beat
 - C any combination of coupled beats
- 35 *Premature beats of ventricular origin*
- A always indicates myocardial disease
 - B frequently occur in the absence of demonstrable cardiac disease
- 36 *Ventricular tachycardia is usually regular but at times may show slight irregularity of the R R intervals*
- A True
 - B False
- 37 *One of the requirements for ventricular tachycardia is*
- A a pacemaker in a ventricle which sends out a series of successive ventricular contractions
 - B ventricular ectopic beats which show retrograde conduction
 - C ventricular ectopic beats which fail to show retrograde conduction

ARTIFACTS

- 38 *When the right arm and left arm lead wires have been attached incorrectly to the arms (lead I lines interchanged) the three standard leads can be corrected by viewing*
- A lead I as its mirror image and interchanging leads II and III
 - B lead III as the mirror image and interchanging leads I and II
- 39 *When the left arm and left leg wires have been attached incorrectly to these limbs while forming the lead III connection (lead wires interchanged) the standard leads can be corrected by viewing*
- A lead III as its mirror image and interchanging leads I and II
 - B lead II as its mirror image and interchanging leads I and III
- 40 *When the right arm and left leg lead wires have been attached incorrectly to these limbs when forming the connections for lead II (lead wires interchanged) the standard leads can be corrected by viewing*
- A all leads as their mirror images and interchanging leads I and III
 - B lead II as the mirror image and by interchanging leads I and III
- 41 *Negative P QRS and T waves in lead I with P waves preceding and T waves following QRS complexes suggests*
- A typical right bundle branch block
 - B typical right ventricular enlargement
 - C dextrocardia or reversal of the right arm and left arm lead wires when making the lead I connection
 - D a lead mounted upside down

CONDUCTION DEFECTS

- 42 *A first degree AV block is*
- A diagnostic of rheumatic heart disease
 - B diagnostic of ischemia of the AV node
 - C not diagnostic of any specific state

- 43 A first degree block (prolonged P R interval) usually indicates changes in the
 A sinus node
 B atrioventricular node
 C bundle of His
- 44 a complete atrioventricular block is characterized by QRS complexes which
 A are never wider than 0.12 second
 B are always wider than 0.12 second
 C may be of normal duration or prolonged
- 45 A complete AV block with idioventricular rhythm indicates the presence of a block in the
 A sinus node
 B atrioventricular node
 C bundle of His
- 46 The Wenckebach phenomenon is a type of
 A complete AV block
 B incomplete AV block with dropped beats
 C incomplete AV block without dropped beats
- 47 The Wenckebach phenomenon is
 A progressive lengthening of P R interval with eventual dropping of a ventricular beat
 B excessive sinus arrhythmia not respiratory in origin
 C progressive lengthening of P R with dropping of a ventricular beat after every second wave
 D cyclic variations in P R without dropping of beats
- 48 Anomalous atrioventricular conduction (Wolff Parkinson White)
 A is never associated with organic cardiac disease
 B is always associated with organic cardiac disease
 C may or may not be associated with organic cardiac disease
- 49 Anomalous atrioventricular conduction (Wolff Parkinson White) is characterized by
 A short P R intervals and wide QRS complexes
 B prolonged P R intervals and QRS complexes of short duration
 C long P R intervals and slurring of QRS complexes
- 50 Which of the following is most consistent with typical complete left bundle branch block?
 A Q waves in lead I
 B QRS complexes which measure from 0.10 to 0.12 second
 C QS waves in leads V₁ and V₂ with QRS complexes which are greater than 0.12 second in duration
- 51 In the presence of a left bundle branch block QS waves in leads V₅ and V₆
 A suggest a myocardial infarct
 B rule out a myocardial infarct
 C suggest left ventricular hypertrophy
- 52 In typical left bundle branch block the J point ST segments and T waves are usually
 A concordant with the major deflections of the QRS complexes
 B discordant with the major deflections of the QRS complexes
- 53 A right bundle branch block may be a congenital abnormality
 A True
 B False

- 54 *An incomplete right bundle branch block in the electrocardiogram suggests interruption of some of the fibers of the right bundle of His*
- A True
 - B False
- 55 *In the presence of a right bundle branch block large Q waves in leads V₃ V₄ and V₅ suggest*
- A an anterior myocardial infarct
 - B a posterior myocardial infarct
 - C right ventricular hypertrophy
- 56 *In the presence of a right bundle branch block elevated J points and coved ST segments with inverted T waves in leads V₃ V₄ and V₅ which persist for 24 hours or more suggest*
- A an anterior myocardial infarct or pericarditis
 - B posterior myocardial ischemia
 - C pulmonary infarction
- 57 *The prognosis with a complete right bundle branch block generally is*
- A more favorable than with a complete left bundle branch block
 - B less favorable than with a left bundle branch block
- 58 *Incomplete right bundle branch block is common when lead V₃R or V₁ shows an rSR prime wave with the onset of the intrinsicoid deflection of the R prime wave from*
- A 0.035 to 0.05 second
 - B 0.05 to 0.075 second
 - C 0.08 second or greater
- 59 *A right bundle branch block makes it impossible to diagnose a large posteroinferior myocardial infarct*
- A True
 - B False
- 60 *Sinoauricular block may be due to*
- A epinephrine
 - B atropine
 - C digitalis
 - D theophylline

DISEASE STATES[†]

(CONGENITAL AND ACQUIRED)

- 61 *The electrocardiogram is diagnostic of at least one of the following types of congenital heart diseases*
- A Tetralogy of Fallot
 - B Eisenmenger's complex
 - C Dextrocardia
 - D Interatrial septal defect
- 62 *Uncomplicated atrial septal defects of significant size generally are characterized by electrocardiographic evidence of*
- A right ventricular hypertrophy or right bundle branch block
 - B left ventricular hypertrophy
 - C left bundle branch block

- 63 *Ventricular septal defects uncomplicated by other congenital abnormalities produce no abnormalities in the tracing if the defect is small however if it is large there may be evidence of left or right or left and right ventricular hypertrophy*
- A True
 - B False
- 64 *Large or many pulmonary veins emptying into the right atrium generally result in the electrocardiographic picture of*
- A left ventricular hypertrophy
 - B right ventricular hypertrophy
 - C left bundle branch block
- 65 *Transposition of the great vessels results in the electrocardiographic picture of pure left ventricular hypertrophy without right ventricular hypertrophy*
- A True
 - B False
- 66 *The electrocardiogram of Ebstein's syndrome suggests*
- A right atrial and left ventricular hypertrophy
 - B left atrial hypertrophy in the absence of right ventricular hypertrophy
 - C right atrial hypertrophy and right complete bundle branch block or intraventricular block
- 67 *The electrocardiogram from a patient with a patent ductus arteriosus which is uncomplicated by other abnormalities typically*
- A is normal or shows evidence of left ventricular hypertrophy
 - B shows evidence of right ventricular hypertrophy without left ventricular hypertrophy
- 68 *Coarctation of the aorta in the adult shows usually*
- A a left ventricular hypertrophy pattern or occasionally a normal electrocardiogram
 - B right bundle branch block
 - C right ventricular hypertrophy
- 69 *Tricuspid atresia with a nonfunctioning right ventricle and an interatrial septal defect characteristically produces*
- A a right ventricular hypertrophy pattern
 - B a left ventricular hypertrophy pattern
 - C a normal electrocardiogram
- 70 *Truncus arteriosus existing as an uncomplicated entity is associated with a left ventricular hypertrophy pattern*
- A True
 - B False
- 71 *The tetralogy of Fallot without a ductus arteriosus or other additional abnormalities characteristically shows*
- A a left ventricular hypertrophy pattern
 - B a left bundle branch block
 - C a right ventricular hypertrophy pattern
- 72 *Pulmonary stenosis with intact atrial and ventricular septa shows characteristically*
- A right ventricular hypertrophy or occasionally a normal electrocardiogram
 - B left ventricular hypertrophy
 - C right and left ventricular hypertrophy

- 73 *Rheumatic mitral stenosis frequently shows a vertical electrocardiographic position of the heart with wide notched P waves in leads I and II or atrial fibrillation*
- A True
 - B False
- 74 *Aortic stenosis and insufficiency usually are characterized by*
- A left ventricular hypertrophy
 - B right ventricular hypertrophy
 - C no ventricular hypertrophy
- 75 *The electrocardiogram is always abnormal with disseminated lupus erythematosus*
- A True
 - B False
- 76 *P waves in pulmonary emphysema often are*
- A wide and notched in leads I II and aV_L
 - B wide and notched in leads II III and aV_F
 - ✓ C tall and pointed in leads II III and aV_F
 - D tall and pointed in leads I II and aV_L
- 77 *Severe hyperthyroidism produces often*
- A complete atrioventricular block
 - B sinus bradycardia
 - C atrial fibrillation or atrial flutter
- 78 *Severe hypothyroidism produces often*
- A complete atrioventricular block
 - B sinus bradycardia
 - C atrial fibrillation or atrial flutter

DRUGS AND ELECTROLYTES

- 79 *Digitalis in digitalizing doses typically produces*
- A short Q T intervals
 - B no change in Q T intervals
 - C long Q T intervals
- 80 *Digitalis therapy may result in*
- A prolongation of P R interval but not in higher degrees of AV block
 - B a complete AV block
 - C an intraventricular conduction delay
- 81 *Digitalis usually slows the ventricular rate significantly in patients with*
- A atrial fibrillation
 - B tachycardia due to toxic states or infections if congestive heart failure is not present
- 82 *Digitalis shifts the J point in most leads*
- A opposite to the major deflections of the QRS complexes
 - B in the same direction as the major deflections of the QRS complexes
- 83 *Quinidine characteristically*
- A shortens Q T intervals
 - B lengthens Q T intervals
 - C does not alter Q T intervals

- 84 *Quinidine characteristically*
- A converts atrial fibrillation to sinus rhythm
 - B produces sinus arrhythmia
 - C shortens the duration of QRS complexes
- 85 *Quinidine increases the ventricular rate in certain patients with atrial flutter*
- A True
 - B False
- 86 *Hypocalcemia of severe degree produces*
- A short Q T intervals
 - B long Q T intervals
 - C no change in Q T intervals
- 87 *In hypokalemia*
- A Q T intervals are prolonged and U waves are prominent
 - B T waves are generally tall and upright
 - C Q T intervals are shortened
 - D QRS increases in length
- 88 *Hyperkalemia is associated with*
- A tall peaked T waves
 - B decreased duration of QRS complexes
 - C long Q T or long Q U intervals
- 89 *Large U waves are a common finding with*
- A hyperkalemia
 - B hypokalemia
 - C rapid cardiac rates
 - D hypernatremia
- 90 *The electrocardiogram is a highly reliable index of the blood potassium level under all circumstances*
- A True
 - B False

ELECTRIC AXIS

- 91 *The mean electric axis of the QRS complexes is normally*
- A less positive in infants than in children
 - B more positive in infants than in children
 - C essentially the same in infants and children
- 92 *Right axis deviation of the QRS complexes greater than 90 degrees is found commonly in patients with dextrocardia tetralogy of Fallot Eisenmenger's complex significant pulmonary stenosis significant atrial septal defect or Lutebacher's syndrome*
- A True
 - B False
- 93 *Left axis deviation or a tendency to left axis deviation of the QRS complexes is present characteristically in adults with significant coarctation of the aorta and in patients with hypogenesis of the right ventricle or with tricuspid stenosis associated with atrial septal defect*
- A True
 - B False
- 94 *Normally the mean electric axis of the T waves*
- A is opposite to the mean electric axis of the QRS complexes
 - B follows in general that of the mean electric axis of the QRS complexes

HYPERTROPHY

(ATRIAL AND VENTRICULAR)

- 95 *Left atrial hypertrophy is characterized often by*
- A narrow tall peaked unnotched P waves of similar configuration in leads II and III
 - B wide notched P waves in leads I and II
 - C inverted P waves in leads II III and aV_F
- 96 *Right atrial hypertrophy is characterized often by*
- A broad notched P waves in leads I and II
 - B narrow tall peaked P waves of similar configuration in leads II and III
 - C inverted P waves in leads II III and aV_F
- 97 *Left ventricular hypertrophy is characterized by high voltage of the R waves in lead aV_L with J points ST segments and T waves which are opposite to the major deflections of the QRS complexes*
- A True
 - B False
- 98 *The average of the electric forces present during ventricular depolarization in a subject with left ventricular hypertrophy is often from the AV node toward the*
- A left shoulder and back of the body
 - B right shoulder and back
 - C left shoulder and front
- 99 *The R waves in lead V₄ with left ventricular hypertrophy characteristically are*
- A tall and often exceed 27.0 mm
 - B short
- 100 *The time of onset of the intrinsicoid deflections in lead V₆ with left ventricular hypertrophy is often*
- A as long as 0.06 second
 - B longer than 0.12 second
 - C longer than 0.16 second
- 101 *Right ventricular hypertrophy is characterized by*
- A tall R waves in leads V₃ V₄ and V₅
 - B tall R waves in leads V₁ and V₂
 - C deep S waves in leads V₁ and V₂
- 102 *Left ventricular hypertrophy*
- A always causes a shift of the mean QRS axis to the left
 - B is recognizable with a normal mean electric axis of the QRS complexes
 - C is a frequent cause of a right axis deviation of QRS complexes
- ✓ 103 *All of the following criteria are in keeping with right ventricular hypertrophy*
- 1 a QR pattern in lead V_{3R} or V₁
 - 2 R waves in lead V₁ which exceed 7.0 mm in amplitude
 - 3 R/S ratios in lead V₁ greater than 1.0
 - 4 ventricular activation times in lead V₁ of 0.035 to 0.05 second
- A True
 - B False

- 104 *In right ventricular hypertrophy the transitional zone in the 6 precordial leads characteristically is shifted*
 - A to the right
 - B to the left
- 105 *Right ventricular hypertrophy in the presence of a right complete bundle branch block*
 - A produces large R prime waves in lead V_1
 - B does not influence the height of the R prime waves in lead V_1

INTRINSICOID DEFLECTION

- 106 *A delayed onset of the intrinsicoid deflections in lead V_5 indicates often*
 - A left bundle branch block and excludes delayed intraventricular conduction
 - B delayed intraventricular conduction and excludes left bundle branch block
 - C left bundle branch block or delayed intraventricular conduction
- 107 *The intrinsicoid deflections are read generally from*
 - A the standard leads
 - B unipolar chest leads
 - C unipolar extremity leads
- 108 *The intrinsicoid deflections recorded from the precordium over the left ventricle normally occur*
 - A earlier than those recorded from the precordium over the right ventricle
 - B later than those recorded from the precordium over the right ventricle
- 109 *In a left bundle branch block and in left ventricular hypertrophy the time of onset of the intrinsicoid deflections in lead V_6 is*
 - A delayed
 - B shortened
 - C normal
- 110 *In right bundle branch block and right ventricular hypertrophy the time of onset of the intrinsicoid deflections in lead V_1 characteristically is*
 - A delayed
 - B shortened
 - C normal

LEADS

- 111 *Lead I measures the differences in potential between*
 - A the left and right arm
 - B right arm and left leg
 - C left arm and left leg
- 112 *Lead II measures the differences in potential between the*
 - A right arm and left arm
 - B left leg and right arm
 - C left arm and left leg

- 113 *Lead III measures the differences in potential between the*
- right arm and left arm
 - right arm and left leg
 - left leg and left arm
- 114 *An upright deflection is written in lead I when the potential at the left arm is relatively*
- positive compared with that at the right arm
 - negative as compared with that of the right arm
 - positive as compared to the left leg
- 115 *An upright deflection is written in lead II when the potential*
- at the right arm is positive with respect to that at the left leg
 - at the right arm is negative with respect to that of the left leg
 - at the left arm is positive with respect to the left leg
- 116 *An upright deflection is written in lead III when the potential*
- at the left arm is positive with respect to the left leg
 - at the left arm is negative with respect to the left leg
 - at the right arm is negative with respect to the left leg
- 117 *An upright deflection is written in a central terminal lead when the exploring electrode is*
- positive with respect to the central terminal
 - negative with respect to the central terminal
 - nearly zero with respect to the central terminal
- 118 *The limb leads aV_R , aV_L and aV_F record differences in potential between one lead which is nearly zero potential throughout the heart cycle and another lead placed on a limb which usually has a significant variable potential throughout the heart cycle*
- True
 - False
- 119 *The standard leads I, II and III are often referred to as*
- unipolar leads
 - bipolar leads
- 120 *Lead V_3 is located*
- on a horizontal line midway between V_1 and V_2
 - on a horizontal line midway between V_5 and V_6
 - on a slanting line midway between leads V_2 and V_4
- 121 *The precordial lead V_2 is located at the junction of the*
- 4th intercostal space and the right sternal border
 - 4th intercostal space and the left sternal border
 - 5th intercostal space and the left sternal border
 - mid clavicular line and the 4th intercostal space
- 122 *If the heart is positioned normally in the chest (intermediate position) the V_6 electrode usually lies over the*
- anterior aspect of the left ventricle
 - posterolateral aspect of the left ventricle
 - over the right ventricle
- 123 *The V_{4R} electrode is placed*
- on the right side of the chest but in the same relative position as the standard V_4 electrode
 - on the right leg
 - above the V_4 electrode

- 124 The esophageal lead is of practical value in differentiating
- atrial fibrillation from atrial tachycardia
 - right from left bundle branch block
 - right from left ventricular hypertrophy
- 125 When the esophageal lead is placed at the atrioventricular groove and atrial depolarization occurs in a normal fashion the P waves are predominantly
- negative
 - positive
 - diphasic
- 126 Einthoven's equation states that at a given instant the sum of the amplitude of the waves is as follows
- I plus III equals II
 - II plus III equals I
 - I plus II equals III
- 127 The unipolar limb lead law states that at a given instant the amplitude of similar waves from the
- right arm left arm and foot equals zero ($V_R + V_L + V_F = 0$)
 - right arm left arm and back equals a large positive value ($V_R + V_I + V_B = \text{a large positive value}$)
 - right arm left arm and precordium equals a large negative value ($V_R + V_L + V_P = \text{a large negative value}$)
- 128 The augmented unipolar limb lead law states that at a given instant the sum of the amplitude of similar waves in leads
- aV_R , aV_L and aV_F equals zero
 - I, II and III equals zero
 - V_1 , V_4 and V_6 equals zero
- 129 The standard leads may be derived from unipolar leads from amplitudes of similar waves using following formulas
- V_F minus V_L equals lead I
 - V_F minus V_L equals lead II
 - V_F minus V_L equals lead III
- 130 The augmented unipolar limb leads may be derived from the standard leads using the amplitudes of similar waves with the following formulas
- aV_R equals $\frac{\text{III minus I}}{2}$
 - aV_L equals $\frac{\text{II minus III}}{2}$
 - aV_F equals $\frac{\text{II plus III}}{2}$
- 131 The unipolar limb leads may be derived from the amplitude of waves of the standard leads using the formula
- V_R equals $\frac{\text{II minus III}}{3}$
 - V_L equals $\frac{\text{I minus III}}{3}$
 - V_F equals $\frac{\text{II plus I}}{3}$

MYOCARDIAL INFARCTION

- 132 *A typical anterior transmural myocardial infarct is characterized in the leads overlying the infarct by QS waves and*
- A isoelectric S T segments
 - B positive S T segments
 - C negative S T segments
- 133 *A typical subacute transmural anterior myocardial infarct is characterized in the leads overlying the infarct by QS waves and*
- A S T segments near the isoelectric line and deeply inverted T waves which change in amplitude with time
 - B large positive S T segments which become more positive with time
 - C isoelectric T waves which do not change with time
- 134 *A typical chronic transmural anterior myocardial infarct is characterized in the leads overlying the infarct by QS waves and*
- A essentially isoelectric S T segments and T waves which do not change in amplitude significantly with time
 - B positive S T segments which change from day to day
 - C negative S T segments which change from day to day
- 135 *An old anterior myocardial infarct often does not show diagnostic changes when*
- A a left bundle branch block is present
 - B a right bundle branch block is present
 - C anterior myocardial ischemia is present
- 136 *A strictly anterior myocardial infarct often does not produce diagnostic changes in the three standard and unipolar limb leads*
- A True
 - B False
- 137 *A transmural myocardial infarct involving the anterolateral aspect of the left ventricle is characterized by QS waves in the leads which face the anterolateral wall of the left ventricle*
- A True
 - B False
- 138 *A typical acute anterolateral myocardial infarct is characterized in lead V_4 by S T segment shifts and QRS complexes whose directions with respect to each other are*
- A discordant
 - B concordant
- 139 *R waves in lead V_4 are recorded often in the presence of an anterolateral infarct if the infarct involves only*
- A a thin layer of the epicardium leaving the endocardium intact
 - B a thin layer of the endocardium leaving the epicardium intact
- 140 *An anteroapical myocardial infarct is one which produces significant changes of the QRS complexes in lead*
- A V_1
 - B V_6
 - C V_3

- 141 *A small left ventricular intramural infarct characteristically produces*
- A short Q T intervals
 - B very little change in the QRS complexes
 - C QS waves in leads which overlie the infarct
- 142 *A precordial lead directly overlying a transmural anterior infarct characteristically shows*
- A QR waves
 - B QS waves
 - C RS waves
- 143 *An infarct involving the lateral wall of the left ventricle*
- A often increases the height of the R waves in lead V₁
 - B produces QS waves in lead V₁
 - C does not change the standard 12 lead electrocardiogram
- 144 *A myocardial infarct which involves the lateral wall of the left ventricle usually shows characteristic changes in leads*
- A V₅ or aV_L
 - B II or aV_F
 - C II or III
- 145 *An acute large typical posterior myocardial infarct is characterized in lead aV_F by*
- A relatively deep Q waves and elevated S T segments
 - B relatively deep Q waves and isoelectric S T segments
- 146 *A large subacute posterior myocardial infarct is characterized in lead aV_F by*
- A relatively deep Q waves S T segments which are near the isoelectric line and deeply inverted T waves which change in amplitude in serial tracings
 - B large R waves without Q waves and isoelectric S T segments
 - C inverted T waves with isoelectric S T segments
- 147 *An old posterior myocardial infarct is characterized in lead aV_F by*
- A T waves which change in amplitude from day to day
 - B elevated S T segments which change in amplitude from day to day
 - C relatively deep Q waves with isoelectric S T segments and T waves which do not change in amplitude in serial tracings
- 148 *A typical large acute posterior myocardial infarct is characterized in lead aV_F by J points and S T segments which are*
- A concordant with the initial deflection of the QRS complexes
 - B discordant with the initial deflections of the QRS complexes
- 149 *The electric potentials at the foot lead aV_F which are present during early ventricular depolarization (first 0.04 second) in posterior myocardial infarction are usually relatively*
- A negative
 - B positive
- 150 *A posterior myocardial infarct may exist in the presence of a normal 12 lead electrocardiogram*
- A True
 - B False
- 151 *A posterior myocardial infarct high at the base of the left ventricle consistently produces diagnostic changes in the electrocardiogram*
- A True
 - B False

- 152 *A thin acute subendocardial infarct with the precordial leads overlying the infarct characteristically alters the*
- A ST segments
 - B QRS complexes
 - C U waves
- 153 *A large subendocardial infarct may reduce the amplitude of the R waves in leads overlying the infarct if it involves*
- A the subendocardium only and does not penetrate deeply into the myocardium
 - B the subendocardium and most of the thickness of the myocardium

MYOCARDIAL INJURY AND ISCHEMIA

- 154 *Large transient negative ST segments which appear in lead V₄ after exercises are strongly suggestive of*
- A subendocardial ischemia and injury
 - B subepicardial ischemia and injury
- 155 *Insufficiency of the coronary arteries may exist in the presence of a normal electrocardiogram taken with the patient at rest*
- A True
 - B False
- 156 *During severe attacks of angina pectoris lead V₄ often shows*
- A transient negative ST segments
 - B shortening of QT intervals
- 157 *Ischemia involving certain portions of the posterior wall of the left ventricle may produce tall positive T waves in the precordial leads*
- A True
 - B False
- 158 *Transmural infarction of the anterior wall of the left ventricle produces inverted T waves in the precordial leads which are adjacent to the infarct*
- A True
 - B False

PERICARDITIS

- 159 *Acute severe diffuse pericarditis is characterized in leads I II and V₄ by ST segments which are*
- A elevated
 - B depressed
 - C isoelectric
- 160 *The electrocardiographic changes in diffuse acute pericarditis are due to involvement of the*
- A pericardium
 - B subepicardium
 - C subendocardium

161 *Subacute diffuse pericarditis is characterized by*

- A inverted T waves in leads I II and V₄
- B tall positive T waves in lead I II and V₄
- C widening of the QRS complexes

162 *Chronic pericarditis due to tuberculosis is a cause of low voltage of the QRS complexes*

- A True
- B False

POSITIONS OF THE HEART

(ELECTROCARDIOGRAPH)

163 *The electrocardiographic position shows an excellent correlation with anatomic position of the heart in health and disease*

- A True
- B False

164 *The horizontal electrocardiograph position of the heart is associated often with*

- A clockwise rotation about the long axis as viewed from the apex
- B counterclockwise rotation of the heart about the long axis as viewed from the apex

165 *The horizontal electrocardiographic position is present when the ventricular complexes of lead aV_L resemble those of leads V₅ and V₆ and the ventricular complexes of lead aV_F resemble those of leads V₁ and V₂*

- A True
- B False

166 *The semihorizontal electrocardiographic position is present when the ventricular complexes of lead aV_L resemble those of leads V₅ and V₆ and the ventricular complexes of lead aV_F are small*

- A True
- B False

167 *The intermediate electrocardiographic position is present when the ventricular complexes of leads aV_L and aV_F are similar in form and size and like those of leads V₅ and V₆*

- A True
- B False

168 *The semivertical electrocardiographic position is present when the ventricular complexes of lead aV_F resemble those of leads V₅ and V₆ and the ventricular complexes of lead aV_L are small*

- A True
- B False

169 *The vertical electrocardiographic position is present when the ventricular complexes in lead aV_L resemble those of leads V₁ and V₂ and the ventricular complexes of lead aV_F resemble those leads V₅ and V₆*

- A True
- B False

- 170 *In the normal heart the horizontal electrocardiographic position is associated often with*
- A counterclockwise rotation about the axis as viewed from the apex
 - B clockwise rotation around the long axis as viewed from the apex
- 171 *The indeterminate electrocardiographic position as described by F N Wilson is said to be present when there is no obvious similarities between the ventricular complexes of the unipolar limb leads and the precordial leads*
- A True
 - B False

PULMONARY INFARCTION

- 172 *A large acute pulmonary infarct typically produces*
- A S waves in lead I Q waves elevated S T segments and inverted T waves in leads III and aV_F
 - B S waves in lead I and in lead III Q waves elevated S T segments and inverted T waves
 - C tall R waves in lead I and in lead III Q waves elevated S T segments and inverted T waves
- 173 *A small subacute pulmonary infarct almost always produces S waves in lead I and in lead III Q waves elevated S T segments and inverted T waves*
- A True
 - B False

THEORY

- 174 *Theoretically the QRS complexes are isoelectric in lead III and are positive and of equal amplitude in leads I and II when the ventricular depolarization process moves away from the right arm perpendicular to a line connecting the left arm and left leg electrodes*
- A True
 - B False
- 175 *Lead V_B if connected properly shows the largest QRS complexes when the ventricular depolarization process is perpendicular to*
- A the frontal plane of the body
 - B the saggital plane of the body
- 176 *Ventricular depolarization results in the writing of the*
- A P waves
 - B atrial T waves
 - C QRS complexes
 - D ventricular T waves
- 177 *Atrial repolarization results in the writing of the*
- A P waves
 - B atrial T waves
 - C QRS complexes
 - D U waves
- 178 *The repolarized state of the ventricles is indicated in the electrocardiogram by the*
- A S T intervals
 - B S T segments
 - C time interval between the end of the U waves and the beginning of the QRS complexes

- 179 *The transitional zone of the QRS complexes in the six precordial leads refers to that lead position in which the QRS complexes are*
- A of equal amplitude
 - B predominately positive
 - C predominately negative
- 180 *Normally the endocardium of the ventricles is activated early during the ventricular depolarization process*
- A True
 - B False
- 181 *Theoretically the QRS complexes are isoelectric in lead I and are large and positive and of equal amplitude in leads II and III when the ventricular depolarization process moves toward the foot at an angle with a line connecting the lead I electrodes of*
- A 90 degrees
 - B 30 degrees
 - C 60 degrees
- 182 *The QRS complexes are small in lead II and are tall and positive in lead I when the ventricular depolarization process moves toward the left arm perpendicular to a line connecting the right arm and left foot electrodes*
- A True
 - B False
- 183 *An electromotive force generated perpendicular to the frontal plane of the body results in lead I in*
- A tall positive deflections
 - B deep negative deflections
 - C the smallest deflections
- 184 *Inhibition of the ventricular depolarization process sometimes is called defective intraventricular conduction*
- A True
 - B False
- 185 *The electric potentials of the heart as detected at the surface of the body are*
- A inversely proportional to the square of the distance between the heart and the electrode
 - B inversely proportional to the cube of the distance between the heart and the electrode
 - C directly proportional to the cube of the distance between the heart and the electrode
- 186 *A vector quantity is often represented*
- A as a point on a graph
 - B as an arrow with the length of the arrow representing magnitude and position and the arrowhead representing direction
- 187 *A scalar quantity is often represented*
- A as a point on a graph
 - B as an arrow with the length representing magnitude and the position of the arrow and the arrowhead representing direction
- 188 *The vector sum of the instantaneous QRS axes is equal to the mean electric QRS axis*
- A True
 - B False

- 189 The ventricular gradient is derived from
 A the QRS complexes and T waves
 B P waves and auricular P waves
 C QRS complexes and P waves
- 190 Potassium chloride in adequate concentration when applied locally to a portion of a cell membrane produces a current of injury
 A True
 B False
- 191 The direction of the mean electric axis of the QRS complexes normally is from the
 A apex of the heart to the valvular orifices (base of the heart)
 B valvular orifices to the apex of the heart
- 192 The vectorcardiogram represents as a series of vectors many of the instantaneous electric forces which are associated with cardiac activity
 A True
 B False
- 193 A homogenous volume conductor is a medium which permits the conduction of a current equally in all directions
 A True
 B False
- 194 The quartz fiber of a string galvanometer moves because the current from the patient flowing over the fiber produces an electromagnetic field which interacts with a magnetic field produced by a fixed magnet
 A True
 B False
- 195 One of Kirchoff's laws states that the algebraic sum of all electric forces flowing to a single point in a network is zero
 A True
 B False
- 196 The smallest squares on the background graph of the standard electrocardiogram measure
 A 100 microvolts tall and 0.02 second in duration
 B 10 microvolts tall and 0.2 second in duration
 C 100 microvolts tall and 0.04 second in duration
- 197 The string galvanometer for electrocardiography was described first by
 A Waller in 1887
 B Einthoven in 1903
 C Wilson in 1906
- 198 The size and direction of the ventricular deflections in any lead depend upon
 A the proximity of the lead to the ventricular myocardium only
 B the proximity of the lead to the ventricular myocardium, the thickness of ventricular myocardium and the direction in which the electromotive forces are directed with respect to the position of the electrodes

WAVES, INTERVALS, SEGMENTS AND J POINT

- 199 *Broad and notched P waves in leads I and II*
A suggests cor pulmonale
B are diagnostic of atrial infarction
C are seen often in mitral stenosis
- 200 *Notching of the P waves without abnormalities of height or duration is*
A diagnostic of cardiac disease
B not diagnostic of cardiac disease
- 201 *P waves typical of chronic cor pulmonale are*
A wide and notched leads I II and aV_L
B wide and notched in leads II III and aV_F
C tall and peaked in leads II III and aV_F
- 202 *The upper limit of normal for duration of P waves in adults is*
A 0.06 second
B 0.08 second
C 0.11 second
- 203 *Wide notched P waves in leads I and II are suggestive of enlargement of the*
A left atrium
B right atrium
- 204 *The amplitude of the P waves in lead II for most adults normally does not exceed*
A 100 microvolts
B 150 microvolts
C 250 microvolts
- 205 *Prolonged P R intervals are*
A diagnostic of rheumatic heart disease
B not in themselves diagnostic of rheumatic heart disease
- 206 *Prolonged P R intervals during a febrile illness are*
A pathognomonic of rheumatic fever
B not pathognomonic of rheumatic fever
- 207 *The P R interval measures the time required for*
A sino atrial conduction only
B conduction through the atria and through the atrioventricular node
C conduction through the Purkinje system
- 208 *In measuring the P R interval it is advisable to make the measurement in a lead in which the P waves are wide and there are prominent Q waves or wide QRS complexes*
A True
B False
- 209 *Q waves in lead aV_F which measure 0.04 second from the beginning of the wave to the nadir indicate often a posterior myocardial infarct*
A True
B False

- 210 *Q waves in lead aV_F which are more than 28 percent of the height of the R waves when the amplitude of the QRS complexes is greater than 5.0 mm indicate usually a posterior myocardial infarct*
- A True
 - B False
- 211 *Relatively deep Q waves (up to 0.6 millivolt) in lead III*
- A are diagnostic of a posterior myocardial infarct
 - B are often normal
 - C rule out a posterior infarct
- 212 *Septal Q waves often are seen in lead I and generally are less than 0.03 second in duration and less than 3.0 mm deep*
- A True
 - B False
- 213 *QS waves in lead aV_R*
- A indicate infarction of the right ventricle
 - B reflect potential variations of the normally activated endocardium of the heart
 - C are diagnostic of right ventricular enlargement
- 214 *Normally the ventricular depolarization process occurs first from the left to the right side of the septum (Q waves) next from the endocardium to the apex and lateral portion of the left ventricle (R waves) and lastly toward the posterior portion of the heart (S waves)*
- A True
 - B False
- 215 *The QRS complexes of some of the precordial V leads are wider than those of the unipolar limb leads*
- A True
 - B False
- 216 *Wide M shaped QRS complexes which are preceded by P waves in leads V₁ and V₂ suggest*
- A a right bundle branch block
 - B a left bundle branch block
 - C myocardial infarction
- 217 *Wide M shaped QRS complexes which are preceded by P waves in leads V₅ and V₆ suggest*
- A a right bundle branch block
 - B a left bundle branch block
 - C myocardial infarction
- 218 *Splintering of the QRS complexes is common normally in*
- A lead III
 - B lead II
 - C lead I
- 219 *The width of the QRS complexes in the tracings of most normal adult individuals does not exceed 0.10 second in the standard and unipolar limb leads*
- A True
 - B False
- 220 *Low voltage of the QRS complexes in the standard and unipolar limb leads is good evidence of myocardial disease*
- A True
 - B False

- 221 *Wide QRS complexes exceeding 0.12 second*
 A are common with a complete left bundle branch block
 B do not occur with hyperkalemia
 C do not occur with quinidine intoxication
- 222 *The QT intervals*
 A do not vary with the heart rate
 B show a linear relation to the heart rate
 C vary approximately with the square root of the heart rate
- 223 *Short QT intervals occur in*
 A hypothyroidism
 B hyperparathyroidism
 C hypoparathyroidism
- 224 *After large doses of digitalis the QT intervals are characteristically*
 A prolonged
 B shortened
 C unchanged
- 225 *Normally the QT intervals are longer for women than for men and children*
 A True
 B False
- 226 *Long QT intervals in the presence of a normal blood calcium are diagnostic of organic myocardial disease*
 A True
 B False
- 227 *QT_c represents the QT intervals corrected for*
 A temperature
 B heart rate
 C area of the body
 D amplitude of QRS complexes
- 228 *In lead V_3 positive ST segments which measure 0.2 millivolt above the isoelectric line are*
 A diagnostic of anterior myocardial injury
 B diagnostic of pericarditis
 C sometimes encountered normally
- 229 *Abnormally large positive ST segment shifts in lead aV_F which persist for 24 hours or longer usually indicate*
 A a posterior myocardial infarct
 B an anterior myocardial infarct
- 230 *Abnormal ST segment shifts and abnormally inverted T waves in lead V_4 may occur in patients with rheumatic myocarditis*
 A True
 B False
- 231 *With normal QRS complexes and T waves an elevation of the RT junctions in leads V_2 and V_3 of 0.2 mV*
 A are diagnostic of an anteroseptal infarct
 B suggest acute diffuse subendocardial injury
 C are diagnostic of pericarditis
 D may be normal

- 232 *The J point is the point of junction between*
A the QRS complexes and the S T segments
B the P R segment and the QRS complexes
- 233 *Inversion of T waves in leads V₅ and V₆ in the presence of a complete left bundle branch block*
A is diagnostic of ischemia of the left ventricle in addition to a defect in the left bundle of His
B may be secondary effect associated with large QRS complexes
- 234 *Coved and inverted T waves with normal QRS complexes in lead V₄ are diagnostic of myocardial ischemia*
A True
B False
- 235 *Negative T waves in lead I in the presence of clearly positive QRS complexes in this lead are often evidence of cardiac disease*
A True
B False
- 236 *Primary T wave changes are always associated with increased areas under the QRS complexes*
A True
B False
- 237 *T waves in lead III which are more negative than minus 4.0 mm (with normal standardization) generally are*
A abnormal
B normal

PART C

APPENDIX

DETERMINING HEART RATE

(Beats per minute)

mm* Rate	mm* Rate	mm* Rate	mm* Rate	mm* Rate	mm* Rate
1 — 1500	14 — 107	26 — 58	39 — 39	51 — 30	64 — 23
2 — 750	15 — 100	27 — 56	40 — 38	52 — 29	65 — 23
3 — 500	16 — 94	28 — 54	41 — 37	53 — 28	66 — 23
4 — 375	17 — 88	29 — 52	42 — 36	54 — 28	67 — 22
5 — 300	18 — 83	30 — 50	43 — 35	55 — 27	68 — 22
6 — 250	19 — 79	31 — 48	44 — 34	56 — 27	69 — 22
7 — 214	20 — 75	32 — 47	45 — 33	57 — 26	70 — 21
8 — 187	21 — 71	33 — 45	46 — 33	58 — 26	71 — 21
9 — 167	22 — 68	34 — 44	47 — 32	59 — 25	72 — 21
10 — 150	23 — 65	35 — 43	48 — 31	60 — 25	73 — 20
11 — 136	24 — 63	36 — 42	49 — 31	61 — 25	74 — 20
12 — 125	25 — 60	37 — 41	50 — 30	62 — 24	75 — 20
13 — 115		38 — 40		63 — 24	

*Number of millimeters (0.04 sec per mm) between recurring complexes

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AGE AND HEART

AGE	HEART RATE (Beats per minute)			AGE	HEART RATE (Beats per minute)		
	Cases	Mean	Range		Cases	Mean	Range
0 — 24 hrs	14	125	88 to 166	8 — 10 yrs	16	81	62 to 142
0 — 2 yrs	16	127	107 156	11 — 14	15	81	55 126
2 — 4	16	99	72 125	Adults	1000	64	38 100*
5 — 7	37	88	71 109				

*Three adults in this series had heart rates greater than 100 the highest being 110

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- Yu P N G Joos H A and Katsampes C P Unipolar electrocardiogram in normal infants and children Am Heart J 41 91 104 (Jan) 1951
- Ziegler R F Electrocardiographic Studies in Normal Infants and Children Springfield Ill Charles C Thomas 1951

P WAVES

AMPLITUDE (mm)

LIMB LEADS					PRECORDIAL LEADS				
Lead	Age	# Cases	Mean	Range	Lead	Age	# Cases	Mean	Range
I	24 hrs	32	0.8	0.0 to 1.5	V ₁	24 hrs	41	0.1	0.0 to 2.0
	1-3 yrs	57	1.2	0.5 2.5		1-3 yrs	36	0.8	-1.0 2.0
	3-5	53	1.1	0.5 2.0		3-5	28	1.0	0.0 2.5
	5-8	90	1.1	0.5 2.0		5-8	44	0.9	0.0 2.5
	12-16	68	0.9	0.0 2.0		12-16	45	0.4	0.0 1.5
	Adults	500	0.7	0.1 1.3		Adults	121	0.6	-0.8 1.6
II	24 hrs	32	1.5	0.0 2.5	V ₂	24 hrs	41	1.1	0.0 2.0
	1-3 yrs	57	1.7	0.0 3.0		1-3 yrs	36	1.4	0.0 2.0
	3-5	53	1.7	0.5 3.0		3-5	28	1.2	0.0 1.5
	5-8	90	1.7	0.5 3.0		5-8	44	1.3	0.0 2.0
	12-16	68	1.6	1.0 3.0		12-16	45	1.1	0.0 2.0
	Adults	500	1.4	0.3 2.5		Adults	121	0.8	0.2 1.6
III	24 hrs	32	0.6	-1.0 2.0	V ₃	24 hrs	41	1.7	1.0 3.0
	1-3 yrs	57	0.7	-1.5 1.5		1-3 yrs	36	1.2	0.0 2.0
	3-5	53	0.6	-1.0 2.0		3-5	28	1.1	1.0 1.5
	5-8	90	0.7	-1.0 2.0		5-8	44	1.1	0.5 1.5
	12-16	68	0.7	-0.5 2.0		12-16	45	1.0	0.5 1.5
	Adults	500	0.7	-0.5 1.9		Adults	121	0.6	0.0 1.8
aV _R	24 hrs	32	-0.9	-2.0 1.5	V ₄	24 hrs	41	1.1	0.5 2.0
	0-2 yrs	16	-0.8	-1.5 -1.0		1-3 yrs	36	1.1	0.5 1.5
	3-5	16	-0.9	-1.2 -0.5		2-4	28	1.0	0.5 1.5
	6-10	53	-0.8	-1.5 -0.2		5-10	44	0.1	0.0 1.5
	12-16	15	-0.8	-1.5 -0.3		11-14	45	1.0	0.3 1.5
	Adults	15	-0.8	-0.1 -1.0		Adults	121	0.6	0.1 2.3
aV _L	24 hrs	32	0.1	-1.5 1.5	V ₅	24 hrs	41	1.3	1.0 2.0
	0-2 yrs	16	0.1	-0.1 0.8		1-3 yrs	36	0.1	0.5 1.5
	3-5	16	0.2	-0.5 1.0		2-4	28	0.9	0.5 1.0
	6-10	53	0.3	-0.5 2.0		5-10	44	0.8	0.0 1.5
	12-16	15	0.2	-0.1 0.6		11-14	45	0.9	0.3 1.0
	Adults	15	0.1	-0.5 0.8		Adults	121	0.6	0.0 2.4
aV _F	24 hrs	32	1.1	-1.0 2.0	V ₆	24 hrs	41	0.9	0.0 2.0
	0-2 yrs	16	0.8	0.2 1.5		1-3 yrs	36	0.8	0.5 1.5
	3-5	16	0.6	0.0 1.5		2-4	28	0.8	0.5 1.0
	6-10	53	0.6	0.2 2.0		5-10	44	0.8	0.0 1.5
	12-16	15	0.5	0.0 1.5		11-14	45	0.7	0.3 1.0
	Adults	15	0.8	-0.3 1.5		Adults	121	0.6	0.0 1.4

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- 5 Ziegler R F Electrocardiographic Studies in Normal Infants and Children Springfield Ill: Charles C Thomas 1951
- 6 Sokolow M and Lyon T P Ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads Am. Heart J 37 161-186 (Feb.) 1949
- 7 Winsor T Unpublished data

P WAVES
DURATION* (Seconds)

AGE	NO CASES	MEAN	RANGE
0 — 24 hrs	14	0 05	0 04 to 0 06
1 — 3 yrs	57	0 06	0 05 0 09
3 — 5	53	0 07	0 04 0 10
5 — 8	90	0 07	0 05 0 10
8 — 12	88	0 08	0 05 0 10
12 — 16	68	0 08	0 06 0 10
Adults	100	0 08	0 06 0 11

* *Widest P waves of the 6 limb and 6 precordial leads usually $\frac{1}{2}$ V₁ or V₂*

REFERENCES

- 1 Ziegler R F Electrocardiographic Studies in Normal Infants and Children Springfield Ill Charles C Thomas 1951
- 2 Ashman R and Hull E Essentials of Electrocardiography 2nd ed N Y Macmillan Company 1941

Q WAVES

AMPLITUDE (mm)

LIMB LEADS					PRECORDIAL LEADS				
Lead	Age	# Cases	Mean	Range	Lead	Age	# Cases	Mean	Range
I	24 hrs	32	0.5	0.0 to 0.5	V ₁	24 hrs	41	0.0	0.0 to 0.0
	0-2 yrs	72	0.7	0.0 2.0		0-2 yrs	72	0.0	0.0 0.0
	3-5	72	0.1	0.0 1.0		3-5	72	0.0	0.0 0.0
	6-10	72	0.2	0.0 2.0		6-10	72	0.0	0.0 0.0
	12-16	68	0.1	0.0 3.0		12-16	49	0.0	0.0 0.0
	Adults	500	0.9	0.0 4.0		Adults	121	0.0	0.0 0.0
II	24 hrs	32	1.5	0.0 5.0	V ₂	24 hrs	41	0.0	0.0 0.0
	0-2 yrs	72	1.3	0.0 3.0		0-2 yrs	72	0.0	0.0 0.0
	3-5	72	0.3	0.0 2.0		3-5	72	0.0	0.0 0.0
	6-10	72	0.5	0.0 3.0		6-10	72	0.0	0.0 0.0
	12-16	68	1.2	0.0 2.5		12-16	49	0.0	0.0 0.0
	Adults	500	1.1	0.0 4.0		Adults	121	0.0	0.0 0.0
III	24 hrs	32	2.5	0.5 9.0	V ₃	24 hrs	41	0.0	0.0 0.0
	0-2 yrs	72	1.6	0.0 4.0		0-2 yrs	72	0.0	0.0 0.0
	3-5	72	1.4	0.0 3.0		3-5	72	0.0	0.0 0.0
	6-10	72	0.6	0.0 3.0		6-10	72	0.4	0.0 1.0
	12-16	68	1.6	0.0 5.0		12-16	49	0.0	0.0 0.7
	Adults	500	1.4	0.0 6.0		Adults	121	0.0	0.0 0.5
aV _R	24 hrs	32	2.4	0.0 4.0	V ₄	24 hrs	41	1.3	0.0 1.5
	0-2 yrs	16	1.6	0.0 10.5		0-2 yrs	72	0.1	0.0 1.0
	2-4	16	2.9	0.0 10.0		3-5	72	0.3	0.0 2.5
	5-10	53	1.4	0.0 10.0		6-10	72	0.2	0.0 1.5
	11-14	15	1.0	0.0 8.0		10-15	49	0.1	0.0 2.4
	Adults	151	2.0	0.0 8.0		Adults	121	0.1	0.8 1.6
aV _L	24 hrs	32	1.3	0.0 2.0	V ₅	24 hrs	41	2.2	0.0 5.5
	0-2 yrs	16	0.1	0.0 0.5		0-2 yrs	72	0.8	0.0 6.0
	2-4	16	0.2	0.0 1.0		3-5	72	0.8	0.0 3.0
	5-10	53	0.1	0.0 1.0		6-10	72	0.6	0.0 4.0
	11-14	15	0.1	0.0 0.5		10-15	49	0.3	0.0 2.1
	Adults	151	0.2	0.0 3.5		Adults	121	0.5	0.0 2.1
aV _F	24 hrs	32	1.8	0.0 6.0	V ₆	24 hrs	41	1.3	0.0 2.0
	0-2 yrs	16	1.2	0.0 4.0		0-2 yrs	72	1.1	0.0 3.0
	2-4	16	1.3	0.0 4.0		3-5	72	0.7	0.0 2.5
	5-10	53	0.5	0.0 3.0		6-10	72	0.4	0.0 3.0
	11-14	15	0.4	0.0 2.0		10-15	49	0.5	0.0 1.7
	Adults	151	0.5	0.0 3.0		Adults	121	0.4	0.0 2.7

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- 1 Lepeschkin E. Modern Electrocardiography vol I The P Q R S T U Complex. Baltimore: Williams & Wilkins Co. 1951
- 2 Stewart C B and Manning G W. A detailed analysis of the electrocardiograms of 500 RCAF air crew. Am Heart J 27:502-523 (April) 1944
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- 4 Ziegler R F. Electrocardiographic Studies in Normal Infants and Children. Springfield Ill: Charles C Thomas 1951
- 5 Sokolow M and Lyon T P. Ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads. Am Heart J 37:161-186 (Feb) 1949
- 6 Winsor T. Unpublished data
- 7 Battro A and Mendy J C. Precordial leads in children. Arch Int Med 78:31-41 (July) 1946

R WAVES

AMPLITUDE (mm.)

LIMB LEADS					PRECORDIAL LEADS				
Lead	Age	# Cases	Mean	Range	Lead	Age	# Cases	Mean	Range
I	24 hrs	32	2.6	0.0 to 5.5	V ₁	24 hrs	41	16.7	3.0 to 23.0
	0-2 yrs	72	4.2	0.0 10.0		0-2 yrs	16	7.0	1.0 14.5
	3-5	72	5.0	2.0 10.0		2-4	16	7.5	2.0 14.0
	6-10	72	5.0	2.0 9.0		8-10	16	3.6	1.0 9.0
	10-15	49	4.8	1.3 11.4		11-14	15	5.1	0.5 15.5
	Adults	121	5.3	0.7 11.3		Adults	151	2.3	0.0 7.0
II	24 hrs	32	5.5	1.0 21.0	V ₂	24 hrs	41	21.0	3.0 41.0
	0-2 yrs	72	5.7	0.0 14.0		0-2 yrs	16	13.0	4.5 22.0
	3-5	72	7.6	3.0 12.0		2-4	16	12.7	5.0 25.0
	6-10	72	7.2	3.0 13.0		8-10	16	7.8	2.0 14.5
	10-15	49	9.1	3.7 16.0		11-14	15	8.3	1.5 23.5
	Adults	121	7.1	1.8 16.8		Adults	151	5.9	0.0 16.0
III	24 hrs	32	8.8	2.0 21.0	V ₃	24 hrs	41	20.0	14.0 28.0
	0-2 yrs	72	5.6	1.0 11.0		0-2 yrs	16	14.0	3.0 24.0
	3-5	72	5.6	2.0 10.0		2-4	16	13.4	6.0 25.0
	6-10	72	4.2	0.5 13.0		8-10	16	8.4	5.0 12.5
	10-15	49	6.0	0.7 15.8		11-14	15	9.2	3.0 22.0
	Adults	121	3.8	0.3 13.1		Adults	151	8.9	1.5 26.0
aV _R	24 hrs	32	3.7	0.0 9.0	V ₄	24 hrs	41	19.0	3.0 32.0
	0-2 yrs	16	1.0	0.5 4.0		0-2 yrs	16	20.0	3.5 35.0
	2-4	16	1.3	0.0 3.0		2-4	16	18.5	9.0 30.0
	8-10	16	1.2	0.5 6.0		8-10	16	14.9	4.0 30.0
	11-14	15	1.2	0.5 8.0		11-14	15	17.2	7.0 28.0
	Adults	151	0.8	0.0 5.0		Adults	151	14.2	4.0 27.0
aV _L	24 hrs	32	2.1	1.0 6.0	V ₅	24 hrs	41	12.0	4.5 21.0
	0-2 yrs	16	4.0	0.5 8.0		0-2 yrs	16	16.0	2.5 25.0
	2-4	16	3.1	0.5 7.0		2-4	16	18.4	10.0 26.0
	8-10	16	1.2	0.5 8.8		8-10	16	17.4	6.0 28.0
	11-14	15	1.6	0.5 6.0		11-14	15	16.4	6.0 29.0
	Adults	151	2.1	0.0 10.0		Adults	151	12.1	4.0 26.0
aV _F	24 hrs	32	6.6	2.0 20.0	V ₆	24 hrs	41	4.5	0.0 11.0
	0-2 yrs	16	8.8	0.5 16.0		0-2 yrs	16	12.0	2.0 20.0
	2-4	16	9.5	0.5 19.5		2-4	16	14.6	8.0 23.0
	8-10	16	8.5	3.5 14.0		8-10	16	12.5	5.0 19.1
	11-14	15	10.5	5.0 21.0		11-14	15	13.5	4.0 25.0
	Adults	151	1.3	0.0 20.0		Adults	151	9.2	4.0 22.0

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- 2 Lepeschkin E. Modern Electrocardiography vol 1. The P Q R S-T U Complex. Baltimore. Williams & Wilkins Co. 1951
- 3 Yu P N G, Joos H A and Katsampes C P. Unipolar electrocardiogram in normal infants and children. Am Heart J 41 91 104 (Jan) 1951
- 4 Ziegler R F. Electrocardiographic Studies in Normal Infants and Children. Springfield Ill. Charles C Thomas. 1951
- 5 Sokolow M and Lyon T P. Ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads. Am Heart J 37 161 186 (Feb) 1949

S WAVES

AMPLITUDE (mm)

LIMB LEADS					PRECORDIAL LEADS				
Lead	Age	# Cases	Mean	Range	Lead	Age	# Cases	Mean	Range
I	24 hrs	32	6.3	0.0 to 15.0	V ₁	24 hrs	41	10.0	0.0 to 28.0
	0-2 yrs	72	3.9	0.0 7.0		0-2 yrs	16	4.8	0.5 14.0
	2-5	72	2.5	0.0 6.0		2-4	16	8.6	3.0 16.0
	6-10	72	1.6	0.0 3.0		8-10	16	8.6	3.0 16.0
	10-15	49	1.8	0.0 6.8		11-14	15	11.6	0.0 20.0
	Adults	121	1.0	0.0 3.6		Adults	151	8.6	2.0 25.0
II	24 hrs	32	3.2	0.0 7.0	V ₂	24 hrs	41	22.0	1.0 42.0
	0-2 yrs	72	2.7	0.0 5.0		0-2 yrs	16	9.3	0.5 21.0
	2-5	72	1.6	0.0 4.0		2-4	16	16.0	8.5 30.0
	6-10	72	1.4	0.0 3.5		8-10	16	16.8	8.0 30.0
	10-15	49	1.6	0.0 4.9		11-14	15	20.8	7.0 36.0
	Adults	121	1.2	0.0 4.9		Adults	151	12.7	0.0 29.0
III	24 hrs	32	2.3	0.0 3.0	V ₃	24 hrs	41	26.4	0.0 39.0
	0-2 yrs	72	1.1	0.0 3.5		0-2 yrs	16	10.2	0.5 23.0
	2-5	72	0.8	0.0 5.0		2-4	16	12.7	3.5 21.0
	6-10	72	0.7	0.0 4.0		8-10	16	16.3	8.0 27.0
	10-15	49	0.9	0.0 5.3		11-14	15	14.8	1.0 30.0
	Adults	121	1.2	0.0 5.5		Adults	151	8.8	0.0 25.0
aV _R	24 hrs	32	3.9	0.0 9.5	V ₄	24 hrs	41	23.0	0.0 42.0
	0-2 yrs	16	6.3	0.0 14.0		0-2 yrs	16	10.2	2.0 22.0
	2-4	16	5.9	0.0 14.0		2-4	16	9.0	0.0 20.0
	8-10	16	4.9	0.0 10.0		8-10	16	11.2	4.0 17.0
	11-14	15	8.3	0.0 17.0		11-14	15	8.0	1.0 16.0
	Adults	151	4.3	0.0 13.0		Adults	151	5.2	0.0 20.0
aV _L	24 hrs	32	6.6	0.0 16.0	V ₅	24 hrs	41	12.0	1.5 30.0
	0-2 yrs	16	3.4	0.0 7.0		0-2 yrs	16	6.1	1.0 13.0
	2-4	16	2.7	0.0 6.0		2-4	16	4.4	0.0 11.0
	8-10	16	3.2	0.0 7.0		8-10	16	5.7	0.5 12.0
	11-14	15	3.1	0.0 9.0		11-14	15	3.7	0.5 8.0
	Adults	151	0.4	0.0 18.0		Adults	151	1.5	0.0 6.0
aV _F	24 hrs	32	3.0	0.0 7.5	V ₆	24 hrs	41	4.5	0.0 13.0
	0-2 yrs	16	0.7	0.0 2.5		0-2 yrs	16	2.5	0.0 7.5
	2-4	16	2.1	0.0 14.0		2-4	16	1.6	0.5 5.0
	8-10	16	0.7	0.0 2.0		8-10	16	1.1	0.0 4.0
	11-14	15	0.8	0.0 2.5		11-14	15	0.9	0.0 2.0
	Adults	151	0.2	0.0 8.0		Adults	151	0.6	0.0 7.0

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- 2 Lepeschkin F. Modern Electrocardiography vol 1 The P Q R S T U Complex. Baltimore: Williams & Wilkins Co. 1951
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- 4 Ziegler R F. Electrocardiographic Studies in Normal Infants and Children. Springfield, Ill: Charles C Thomas. 1951
- 5 Sokolow M and Lyon T P. Ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads. Am. Heart J 37 161-186 (Feb) 1949

T WAVES

AMPLITUDE (mm)

LIMB LEADS					PRECARDIAL LEADS				
Lead	Age	# Cases	Mean	Range	Lead	Age	# Cases	Mean	Range
I	24 hrs	41	0.3	-2.0 to 3.0	V ₁	24 hrs	32	1.3	-4.0 to 6.0
	0-2 yrs	72	2.6	0.5 5.0		0-2 yrs	16	-2.3	-4.5 -0.5
	3-5	72	1.7	0.0 4.0		2-4	16	-2.2	-5.5 -1.0
	6-10	72	2.0	0.5 4.0		8-10	16	-1.7	-3.0 1.5
	10-15	49	2.6	1.1 5.0		11-14	15	-1.3	-3.5 0.2
	Adults	500	3.0	1.0 5.0		Adults	151	0.2	-4.0 4.0
II	24 hrs	41	1.2	0.0 3.0	V ₂	24 hrs	32	1.3	-7.5 9.0
	0-2 yrs	72	2.4	1.0 4.0		0-2 yrs	16	-2.4	-6.0 0.4
	3-5	72	1.8	0.5 4.0		2-4	16	-2.6	-7.0 3.0
	6-10	72	2.1	0.5 5.0		8-10	16	0.0	-3.5 5.0
	10-15	49	3.0	0.9 6.5		11-14	15	0.7	-1.5 3.5
	Adults	500	3.8	1.0 6.6		Adults	151	5.5	-3.0 18.0
III	24 hrs	41	1.0	-1.0 3.0	V ₃	24 hrs	32	-0.4	-7.0 4.0
	0-2 yrs	72	0.2	0.0 3.0		0-2 yrs	16	-0.7	-5.0 4.5
	3-5	72	0.2	0.0 1.5		2-4	16	-0.7	-5.0 5.0
	6-10	72	0.1	0.0 1.0		8-10	16	1.8	-2.0 4.5
	10-15	49	0.4	-1.9 3.1		11-14	15	1.7	0.0 5.0
	Adults	500	0.8	-1.4 3.4		Adults	151	5.4	-2.0 16.0
aV _R	24 hrs	41	-0.4	-3.0 2.0	V ₄	24 hrs	32	-0.6	-7.0 3.0
	0-2 yrs	16	-2.0	-3.0 -0.5		0-2 yrs	16	1.7	-2.5 5.0
	2-4	16	-2.5	-5.0 -1.5		2-4	16	2.4	0.0 11.0
	8-10	16	-2.0	-3.5 -0.2		8-10	16	3.2	0.0 9.0
	11-14	15	-2.2	-4.0 -1.5		11-14	15	3.3	0.0 7.0
	Adults	151	-2.3	-5.0 1.5		Adults	151	4.8	0.0 17.0
aV _L	24 hrs	41	0.1	-1.5 2.0	V ₅	24 hrs	32	1.3	-4.0 5.0
	0-2 yrs	16	0.7	-0.5 2.0		0-2 yrs	16	2.6	1.2 5.5
	2-4	16	1.4	-0.5 3.0		2-4	16	3.4	0.0 7.0
	8-10	16	0.7	-1.0 2.5		8-10	16	4.1	0.5 11.0
	11-14	15	0.8	0.5 2.0		11-14	15	3.1	1.0 5.0
	Adults	151	0.5	-4.0 6.0		Adults	151	3.4	0.0 9.0
aV _F	24 hrs	41	0.9	-1.0 3.0	V ₆	24 hrs	32	1.2	-3.0 6.0
	0-2 yrs	16	1.6	0.8 3.5		0-2 yrs	16	2.2	0.5 4.0
	2-4	16	1.8	-0.2 4.0		2-4	16	3.2	1.5 5.0
	8-10	16	1.4	-0.2 3.0		8-10	16	3.1	0.0 8.0
	11-14	15	1.3	0.0 3.5		11-14	15	2.3	1.0 4.0
	Adults	151	1.7	-0.5 5.0		Adults	151	2.4	-0.5 5.0

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- 1 Battro A and Mendy J C. Precordial leads in children. Arch Int Med 78 31-41 (July) 1946
- 2 Lepeschkin E. Modern Electrocardiography vol 1 The P Q R S-T U Complex. Baltimore: Williams & Wilkins Co 1951
- 3 Stewart C B and Manning G W. A detailed analysis of the electrocardiograms of 500 R.C.A.F. air crew. Am Heart J 27 507-523 (April) 1944
- 4 Yu P N G, Joos H A and Katsampes C P. Unipolar electrocardiogram in normal infants and children. Am Heart J 41 91-104 (Jan) 1951
- 5 Ziegler R F. Electrocardiographic Studies in Normal Infants and Children. Springfield Ill: Charles C Thomas 1951
- 6 Sokolow M and Lyon T P. Ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads. Am Heart J 37 161-186 (Feb) 1949

QRS COMPLEXES
DURATION* (Seconds)

Age	# Cases	Mean	Range
24 hrs	14	0.06	0.04 to 0.10
0—2 yrs	16	0.06	0.05 0.08
2—4	16	0.07	0.05 0.08
5—7	35	0.07	0.06 0.08
8—10	16	0.07	0.05 0.08
11—14	14	0.07	0.06 0.08
Adults	100	0.08	0.06 0.10

*Widest QRS complex of the 6 limb and 6 precordial leads usually V₁, V₂ or V₃

REFERENCES

- 1 Yu P N G Joos H A and Katsampes C P Unipolar electrocardiogram in normal infants and children *Am Heart J* 41: 91-104 (Jan) 1951
- 2 Ziegler R F *Electrocardiographic Studies in Normal Infants and Children* Springfield Ill Charles C Thomas 1951
- 3 Ashman R and Hull E *Essentials of Electrocardiography* 2nd ed N Y Macmillan Company 1941

RATIOS OF WAVES* (Amplitudes)

Adults

LEAD	Q/R		R/S		R/T	
	Mean	Range	Mean	Range	Mean	Range
aV _R	4.97	0.0 to 14.0	0.0	0.0 to 0.1	0.0	0.0 to 0.0
aV _L	0.24	0.0 0.75	1.5	0.0 8.0	2.6	0.1 10.0
aV _F	0.10	0.0 0.28	2.4	0.0 16.0	4.6	0.3 14.0
V ₁			0.3	0.0 1.0	1.4	0.3 7.0
V ₂			0.2	0.1 13.0	1.4	0.2 12.0
V ₃			1.4	0.1 10.1	1.9	0.3 13.0
V ₄	0.04	0.0 0.10	4.1	0.2 19.0	3.1	0.3 9.0
V ₅	0.07	0.0 0.16	7.3	1.0 24.0	3.5	1.0 9.0
V ₆	0.09	0.0 0.21	9.0	2.3 22.0	4.1	1.7 10.0

*16 to 151 cases

REFERENCES

- 1 Sokolow M and Lyon T P Ventricular complex in left ventricular hypertrophy as obtained by unipolar precordial and limb leads *Am Heart J* 37 161 186 (Feb) 1949

INTRINSICOID DEFLECTIONS FOR VARIOUS AGES (V_1 and V_6)*

Age	# Cases	V_1		V_6	
		Mean	Range	Mean	Range
1—7 weeks		0 012	0 005 to 0 025	0 020	0 010 to 0 028
2—12 months		0 013	0 005 0 026	0 024	0 018 0 036
1—2 years		0 016	0 004 0 026	0 028	0 018 0 036
2—6		0 017	0 004 0 026	0 030	0 020 0 040
6—13		0 018	0 004 0 026	0 030	0 020 0 040
Adults	100	0 017	0 000 0 030	0 039	0 016 0 052

REFERENCES

- 1 Myers G B et al Normal variations in multiple precordial leads Am Heart J 34 785 808 (Dec) 1947
- 2 Nicolson G Clinical Electrocardiography in Children N Y Macmillan Company 1953
- 3 Winsor T Unpublished data

INTRINSICOID DEFLECTIONS

(Leads V_1 through V_6)*

# Cases	Sex	Age	Lead	Mean	Min	Max	Stand Dev
100	M	10 to 20	V_1	0 020	0 000	0 031	0 0043
			V_2	0 022	0 012	0 030	0 0039
			V_3	0 026	0 014	0 044	0 0050
			V_4	0 029	0 015	0 052	0 0061
			V_5	0 037	0 022	0 053	0 0066
			V_6	0 037	0 024	0 050	0 0063

Measured from beginning of QRS complex to peak of R waves in seconds

REFERENCES

- 1 Sodi Pallares D et al La deflexion intrinseca en casos normales y en hipertrofias ventriculares Arch Inst Cardiol Mexico 16 397-4 0 (Oct 31) 1946

P R INTERVAL FOR VARIOUS AGES AND HEART RATES*

UPPER LIMIT OF NORMAL (Seconds)

Age Years	HEART RATE (Beats per Minute)				
	Below 70	71 90	91 110	111 130	Over 130
0 — 15	0.16	0.15	0.15	0.14	0.13
15 — 6	0.17	0.17	0.16	0.15	0.14
7 — 13	0.18	0.17	0.16	0.15	0.14
14 — 17	0.19	0.18	0.17	0.16	0.15
Small adults	0.20	0.19	0.18	0.17	0.16
Large adults	0.21	0.20	0.19	0.18	0.17

*P R interval (seconds) measured in the standard lead with the tallest P

REFERENCES

- 1 Ashman R and Hull E Essentials of Electrocardiography 2nd ed N Y Macmillan Company 1941

S T SEGMENTS (Elevation or Depression in mm)

Lead	Newborn to 1 year 185 cases		1 to 10 yrs 227 cases		Adults*† 100 cases		
	Min	Max	Min	Max	Mean	Min	Max
I	-0.1	0.1	-1.0	1.0	0.11	-0.3	0.9
II	-0.1	0.2	-1.0	2.0	0.21	-1.0	1.0
III	-0.2	0.2	-1.0	1.0	0.04	-0.6	0.8
aV _R	-0.1	0.1	-1.0	1.0	0.55	-0.6	0.6
aV _L	-0.1	0.1	-1.0	1.0	0.28	-0.5	0.3
aV _F	-0.05	0.2	-1.0	1.0	-0.32	-0.6	1.0
V ₁	-0.2	0.1	-1.0	2.0	0.21	-0.1	0.8
V ₂	-0.2	0.2	-1.0	2.5	0.47	0.0	1.5
V ₃	-0.2	0.25	0.0	2.5	0.58	0.0	2.0
V ₄	-0.1	0.2	0.0	2.0	0.33	-0.1	2.0
V ₅	—	0.2	-1.0	1.2	0.14	-0.5	0.6
V ₆	—	0.1	-1.0	1.0	0.04	-0.5	0.5

*Measurements were made from the base line in front of the P waves

†Unipolar limb and chest lead measurements (93 cases) include all electrocardiographic positions except vertical

REFERENCES

- 1 Kossmann, C E The normal electrocardiogram Circulation 8 920 936 (Dec) 1953
- 2 Winsor T Unpublished data

S T SEGMENTS IN VERTICAL ELECTROCARDIOGRAPHIC POSITION*

(Elevation or Depression in mm) 7 cases

Lead	Mean	Min	Max
I	0.07	-0.3	0.2
II	0.16	-0.5	0.7
III	0.17	-0.4	0.9
aV _R	0.28	-0.3	0.2
aV _L	-0.29	-0.4	0.2
aV _F	0.0	-0.5	1.0
V ₁	0.11	0.0	0.5
V ₂	0.51	0.1	0.8
V ₃	0.66	0.1	2.0
V ₄	0.43	0.1	1.4
V ₅	0.16	0.0	0.7
V ₆	0.17	0.0	0.8

*Measurements made from the base line in front of the P waves

REFERENCES

- 1 Winsor T Unpublished data.

Q T INTERVAL

NORMAL RANGE FOR VARIOUS HEART RATES AND CYCLE LENGTHS

Heart Rate (Min)	Cycle Length (R-R Interval) (Sec)	Lepeschkin	Ashman			
		Lower Limit of Normal (Sec)	Mean (Seconds)		Upper Limit of Normal (Sec)	
			Men & Child	Women	Men & Child	Women
40	1.50	0.42	0.45	0.46	0.49	0.50
43	1.40	0.39	0.44	0.45	0.48	0.49
46	1.30	0.38	0.43	0.44	0.47	0.48
48	1.25	0.37	0.42	0.43	0.46	0.47
50	1.20	0.36	0.41	0.43	0.45	0.46
52	1.15	0.35	0.41	0.42	0.45	0.46
55	1.10	0.34	0.40	0.41	0.44	0.45
57	1.05	0.34	0.39	0.40	0.43	0.44
60	1.00	0.33	0.39	0.40	0.42	0.43
63	0.95	0.32	0.38	0.39	0.41	0.42
67	0.90	0.31	0.37	0.38	0.40	0.41
71	0.85	0.31	0.36	0.37	0.38	0.41
75	0.80	0.30	0.35	0.36	0.38	0.39
80	0.75	0.29	0.34	0.35	0.37	0.38
86	0.70	0.28	0.33	0.34	0.36	0.37
93	0.65	0.28	0.32	0.33	0.35	0.36
100	0.60	0.27	0.31	0.32	0.34	0.35
109	0.55	0.26	0.30	0.31	0.33	0.33
120	0.50	0.25	0.28	0.29	0.31	0.32
133	0.45	0.24	0.27	0.28	0.29	0.30
150	0.40	0.23	0.25	0.26	0.28	0.28
172	0.35	0.22	0.23	0.24	0.26	0.26

REFERENCES

- 1 Lepeschkin E. *Modern Electrocardiography* vol 1 The P-Q-R-S-T-U Complex. Baltimore: Williams & Wilkins Co. 1951
- 2 Ashman R. and Hull E. *Essentials of Electrocardiography* 2nd ed. N.Y.: Macmillan Company. 1941

SQUARE ROOT TABLE FOR CORRECTING Q T INTERVAL FOR HEART RATE

$$\text{Bazett Formula } QT_c = \frac{QT \text{ (seconds)}}{\sqrt{RR \text{ (seconds)}}}$$

(Intervals)

RR	\sqrt{RR}	RR	\sqrt{RR}	RR	\sqrt{RR}	RR	\sqrt{RR}
0 40	0 63	0 61	0 78	0 83	0 91	1 04	1 01
41	64	62	78	84	91	1 05	1 02
42	64	63	79	85	92	1 06	1 02
43	65	64	80	86	92	1 07	1 03
44	66	65	80	87	93	1 08	1 03
45	67	66	81	88	93	1 09	1 04
46	67	67	81	89	94	1 10	1 04
47	68	68	82	90	94	1 11	1 05
48	69	69	83	91	95	1 12	1 05
49	70	70	83	92	95	1 13	1 06
50	70	71	84	93	96	1 14	1 06
51	71	73	85	95	97	1 16	1 07
52	72	74	86	96	97	1 17	1 08
53	72	75	86	97	98	1 18	1 08
54	73	76	87	98	98	1 19	1 09
55	74	77	87	99	99	1 20	1 09
56	74	78	88	1 00	1 00	1 21	1 10
57	75	79	88	1 00	1 00	1 22	1 10
58	76	80	89	1 10	1 00	1 23	1 10
59	76	81	90	1 02	1 00	1 24	1 11
60	77	82	90	1 03	1 01		

NORMAL VALUES OF CORRECTED Q T INTERVALS FOR VARIOUS AGES

Age	# Cases	Mean	Range
0 — 24 hrs	32	0 42	0 37 to 0 53
0 — 2 yrs	16	0 40	0 37 0 42
2 — 4	16	0 40	0 38 0 42
8 — 10	16	0 41	0 39 0 42
11 — 14	15	0 41	0 40 0 42
Adults	48	0 38	0 35 0 44

REFERENCES

- 1 Yu P N G Joos H A and Katsampes C P Unipolar electrocardiogram in normal infants and children *Am Heart J* 41 91 104 (Jan) 1951
- 2 Ziegler R F *Electrocardiographic Studies in Normal Infants and Children* Springfield Ill Charles C Thomas 1951
- 3 Winsor T Unpublished data

NORMAL VALUES FOR ELECTRIC AXES*

(Degrees)

Waves or Complexes	Mean	Range
P	51 0	0 0 to 90 0
QRS	54 0	-30 0 102 0
T	39 0	-11 0 76 0

**Derived from amplitude of waves of leads I and III using tables 44 males and 35 females average age 35 years (range 15 to 50)*

REFERENCES

- 1 Winsor T Unpublished data

LEAD I POSITIVE

	0-0	0-5	1-0	1-5	2-0	2-5	3-0	3-5	4-0	4-5	5-0	6-0	7-0	8-0	9-0	10-0	11-0	12-0	13-0	14-0	15-0	20-0
0-0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
0-5	90	60	40	44	41	39	38	37	36	35	34	33	33	33	32	32	32	32	32	32	32	31
1-0	90	71	60	53	49	46	44	42	41	40	39	38	37	36	35	34	34	34	33	33	33	32
1-5	90	76	67	60	55	52	49	47	45	44	43	41	39	38	38	37	36	36	35	35	35	33
2-0	90	79	71	65	60	56	53	51	49	47	46	44	42	41	40	39	38	38	37	37	36	35
2-5	90	81	74	68	64	60	57	54	52	51	49	47	45	43	42	41	40	39	39	38	38	36
3-0	90	82	76	71	67	63	60	57	55	53	52	49	47	45	44	43	42	41	40	39	39	37
3-5	90	83	78	73	69	66	63	60	58	56	54	51	49	47	46	44	43	42	42	41	40	38
4-0	90	84	79	75	71	68	65	62	60	58	56	53	51	49	47	46	45	44	43	42	42	39
4-5	90	85	80	76	73	69	67	64	62	60	58	55	53	51	49	48	47	45	44	43	43	40
5-0	90	85	81	77	74	71	68	66	64	62	60	57	55	52	51	49	48	47	46	45	44	41
5-5	90	86	82	79	76	73	71	69	67	65	63	60	57	55	53	52	50	49	48	47	46	43
6-0	90	87	83	81	78	75	73	71	69	67	65	63	60	58	56	54	53	51	50	49	48	44
6-5	90	87	84	82	79	77	75	73	71	69	68	65	62	60	58	56	55	53	52	51	50	46
7-0	90	87	85	82	80	78	76	74	73	71	69	67	64	62	60	58	57	55	54	53	52	48
7-5	90	88	85	83	81	79	77	76	74	72	71	68	66	64	62	60	59	57	56	54	53	49
8-0	90	88	86	84	82	80	78	77	75	73	72	70	67	65	63	62	60	59	57	56	55	50
8-5	90	88	86	84	82	81	80	78	77	76	74	72	70	68	66	64	63	61	60	59	58	53
9-0	90	88	87	85	84	82	81	80	78	77	76	74	72	70	68	67	65	64	62	61	60	55
9-5	90	89	88	87	85	84	83	82	81	80	79	77	76	74	72	71	70	68	67	65	65	60

LEAD I POSITIVE

	0-0	0-5	1-0	1-5	2-0	2-5	3-0	3-5	4-0	4-5	5-0	6-0	7-0	8-0	9-0	10-0	11-0	12-0	13-0	14-0	15-0	20-0
0-0	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
0-5	90	50	0	12	16	19	21	22	23	24	25	26	26	27	27	27	28	28	28	28	28	29
1-0	90	60	30	11	0	7	11	14	16	18	19	21	22	23	24	25	25	26	26	26	27	27
1-5	90	71	-49	30	16	7	0	5	7	11	13	16	18	20	21	22	23	23	24	25	25	26
2-0	90	76	60	44	30	19	11	5	0	4	7	11	14	16	18	19	20	21	22	22	23	25
2-5	90	79	67	53	41	30	21	14	8	4	0	6	9	12	14	16	17	19	20	20	21	23
3-0	90	83	71	60	-49	39	30	22	16	11	7	0	5	8	11	13	15	16	17	18	19	22
3-5	90	82	74	65	55	46	38	30	23	19	13	6	0	4	7	10	12	14	15	16	17	21
4-0	90	83	76	66	60	52	44	37	30	24	19	11	5	0	4	7	9	11	13	14	15	19
4-5	90	84	78	71	64	56	49	-42	34	30	25	16	9	4	0	3	6	8	10	12	13	18
5-0	90	85	79	73	67	60	53	-47	41	35	30	21	14	8	4	0	3	6	8	9	11	16
5-5	90	86	81	76	71	66	60	54	49	-44	39	30	22	16	11	7	3	0	3	5	7	13
6-0	90	86	82	78	74	69	65	60	55	51	46	38	30	23	18	13	9	6	3	0	2	10
6-5	90	87	83	80	76	72	68	64	60	56	52	44	37	30	24	19	15	11	6	5	2	7
7-0	90	87	84	81	78	74	71	67	64	60	56	49	-42	36	30	25	20	16	13	9	7	3
7-5	90	87	85	82	79	76	73	70	67	63	60	53	-47	41	35	30	25	21	17	14	11	0
8-0	90	88	85	83	80	77	75	72	69	66	63	57	51	-45	-40	35	30	26	22	18	15	3
8-5	90	88	86	83	81	79	76	74	71	68	66	60	54	49	-44	39	34	30	26	22	19	7
9-0	90	89	86	84	82	80	77	75	73	70	68	63	57	52	-47	43	38	34	30	26	23	10
9-5	90	89	86	84	82	80	78	76	74	72	69	65	60	55	51	46	42	38	34	30	27	13
10-0	90	89	87	85	83	81	79	77	75	73	71	67	62	58	53	-49	45	41	37	33	30	16
10-5	90	89	87	86	85	83	82	81	79	78	76	73	70	-67	63	60	57	53	50	-47	-44	30

REFERENCES

- Jackson C E and Winsor T Aids for determining magnitude and direction of electric axes of the electrocardiogram Circulation 1 975 981 (April) 1950

LEAD I NEGATIVE

	0-0	05	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	200
00	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
05	90	120	131	136	139	141	142	143	144	145	145	146	147	147	147	148	148	148	148	148	148	149
10	90	109	120	127	131	134	136	138	139	140	141	142	143	144	145	145	146	146	146	147	147	148
15	90	104	113	120	125	128	131	133	135	136	137	139	141	142	142	143	144	144	144	145	145	147
20	90	101	109	115	120	124	127	129	131	133	134	136	138	139	140	141	142	142	143	143	144	145
25	90	99	106	112	116	120	123	126	128	129	131	133	135	137	138	139	140	141	141	142	142	144
30	90	98	104	109	113	117	120	123	125	127	128	131	133	135	136	137	138	139	140	141	141	143
35	90	97	102	107	111	114	117	120	122	124	126	129	131	133	134	136	137	138	138	139	140	142
40	90	96	101	105	109	112	115	118	120	122	124	127	129	131	133	134	135	136	137	138	138	141
45	90	95	100	104	107	111	113	116	118	120	122	125	127	129	131	132	133	135	136	137	137	140
50	90	95	99	103	106	109	112	114	116	118	120	123	125	128	129	131	132	133	134	135	136	139
60	90	94	98	101	104	107	109	111	113	115	117	120	123	125	127	128	130	131	132	133	134	137
70	90	93	97	99	102	105	107	109	111	113	115	117	120	122	124	126	127	129	130	131	132	136
80	90	93	96	98	101	103	105	107	109	111	112	115	118	120	122	124	125	127	128	129	130	134
90	90	93	95	98	100	102	104	106	107	109	111	113	116	118	120	122	123	125	126	127	128	132
100	90	92	95	97	99	101	103	104	106	108	109	112	114	116	118	120	122	123	124	126	127	131
110	90	92	94	96	98	100	102	103	105	107	108	110	113	115	117	118	120	121	123	124	125	130
120	90	92	94	96	98	99	101	102	104	105	107	109	111	113	115	117	119	120	121	123	124	128
130	90	92	94	96	97	99	100	102	103	104	106	108	110	112	114	116	117	119	120	121	122	127
140	90	92	93	95	97	98	100	101	102	103	105	107	109	111	113	114	116	117	119	120	121	125
150	90	92	93	95	96	98	99	100	102	103	104	106	108	110	112	113	115	116	118	119	120	125
200	90	91	92	93	95	96	97	98	99	100	101	103	104	106	108	109	110	112	113	115	116	120

LEAD I NEGATIVE

	00	05	10	15	20	25	30	35	40	45	50	60	70	80	90	100	110	120	130	140	150	200
00	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
05	90	150	180	169	164	161	159	158	157	156	155	154	154	153	153	153	152	152	152	152	152	151
10	90	120	150	169	180	173	169	166	164	162	161	159	158	157	156	155	155	154	154	154	153	153
15	90	109	131	150	164	173	180	175	172	169	167	164	162	160	159	158	157	157	156	156	155	154
20	90	104	120	136	150	161	169	175	180	176	173	169	166	164	162	161	160	159	158	158	157	155
25	90	101	113	127	139	150	159	166	172	176	180	174	171	168	166	164	163	161	160	160	159	157
30	90	99	109	120	131	141	150	158	164	169	173	180	175	172	169	167	165	164	163	162	161	158
35	90	98	106	115	125	134	142	150	157	162	167	174	180	176	173	170	168	166	165	164	163	159
40	90	97	104	112	120	128	136	143	150	156	161	169	175	180	176	173	171	169	167	166	165	161
45	90	96	102	109	116	124	131	138	144	150	155	164	171	176	180	177	174	172	170	168	167	162
50	90	95	101	107	113	120	127	133	139	145	150	159	166	172	176	180	177	174	172	171	169	164
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PART D

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This Index includes only electrocardiographic findings and interpretations found in *Electrocardiograms Part A Volume I* (Pages 1-119) and answers to Questions on Electrocardiograms *Part B Volume II* (Pages 1-119). Page numbers in the Index apply to *both* correspondingly numbered pages in *Volume I* and *Volume II*.

Questions and Answers on Electrocardiographic Interpretation are *not* indexed but are listed in appropriate categories in the Table of Contents in both *Volume I* and *Volume II*.

Tables of normal values found in the Appendix *Part C Volume I* are included in the Index.

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